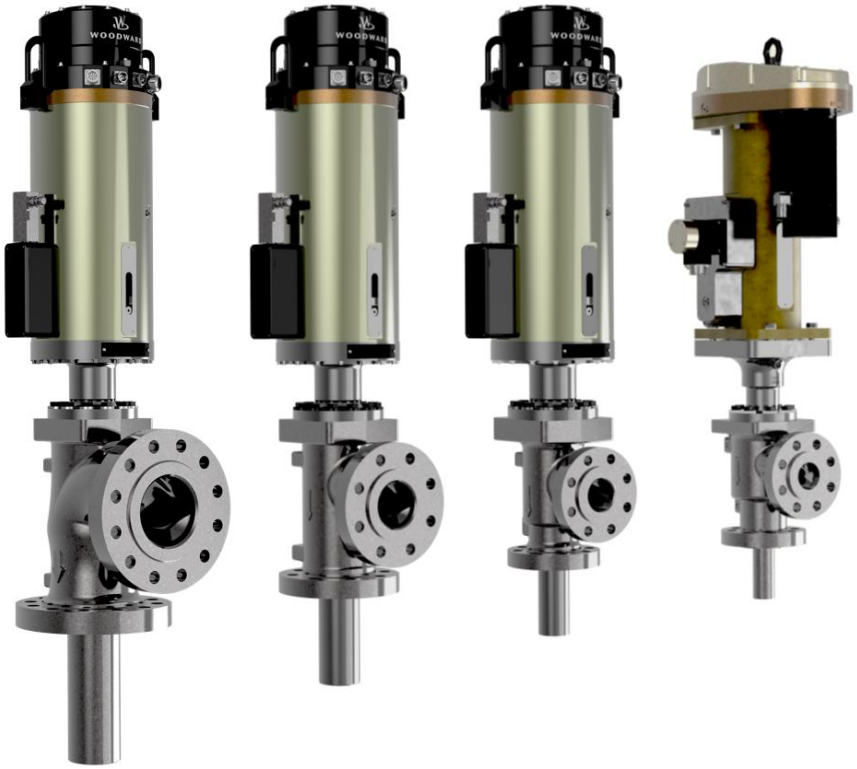
WOODWARD

Product Manual 35076
(Rev U, 5/2025)
Original Instructions



Large Electric Sonic Valve II (LESV II)

2-inch, 3-inch, 4-inch, 6-inch

Installation and Operation Manual

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

This publication may have been revised or updated since this copy was produced. The latest version of most publications is available on the Woodward website.

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If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. The latest version of most publications is available on the Woodward website.

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Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

If your publication is not on the Woodward website, please contact your customer service representative to get the latest copy.

Revisions— A bold, black line alongside the text identifies changes in this publication since the last revision.

Manual 35076

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Important Definitions

This is the safety alert symbol used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER** - Indicates a hazardous situation, which if not avoided, will result in death or serious injury.
- **WARNING** - Indicates a hazardous situation, which if not avoided, could result in death or serious injury.
- **CAUTION** - Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury.
- **NOTICE** - Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT** - Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be completely independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be necessary for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes, but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface, and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. After removing the old PCB from the control cabinet, immediately place it in the antistatic protective bag.

Regulatory Compliance

European Compliance for CE Marking:

These listings are limited only to those units bearing the CE Marking.

EMC Directive (Actuator): Declared to Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC).

ATEX Directive (Actuator): Directive 2014/34/EU on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.
LELA: Zone 2, Category 3, Group II G, Ex nA IIC T3 Gc
LELA 2 without external position sensor: Zone 2, Category 3, Group II G, Ex ec IIC T3 Gc
LELA 2 with external position sensor: Zone 2, Category 3, Group II G, Ex db ec IIC T3 Gc

Pressure Equipment Directive (Valve): Directive 2014/68/EU on the harmonization of the laws of the Member States relating to making pressure equipment available on the market.
2in, 3 in, 4 in: PED Category II
6 in: PED Category III
PED Module H – Full Quality Assurance

Other European Compliance:

Compliance with the following European Directives or standards does not qualify this product for application of the CE Marking:

ATEX Directive: Exempt from the non-electrical portion of the ATEX Directive 2014/34/EU due to no potential ignition sources per EN ISO 80079-36:2016 for Zone 2 installation.

Machinery Directive: Compliant as partly completed machinery with Directive 2006/42/EC of the European Parliament and the Council of 17 May 2006 on machinery.

RoHS Directive: Restriction of Hazardous Substances 2011/65/EU:
Woodward Turbomachinery Systems products are intended exclusively for sale and use only as a part of Large Scale Fixed Installations per the meaning of Art.2.4(e) of directive 2011/65/EU. This fulfills the requirements stated in Art.2.4(c), and as such, the product is excluded from the scope of RoHS2.

Other International Compliance

IECEx (LELA): Certified for use in explosive atmospheres per Certificate:
IECEx CSA 14.0013X
Without position sensor: Ex nA IIC T3 Gc
With position sensor: Ex db e nA IIC T3 Gc

IECEx (LELA2): Certified for use in explosive atmospheres per Certificate:
IECEx ETL 18.0002X
Without Position Sensor: Ex ec IIC T3 Gc
With Position Sensor: Ex db ec IIC T3 Gc

EAC Customs Union: These listings are limited only to those units with labels, markings, and manuals in Russian language to comply with their certificates and declaration.

EAC Customs Union (Marked): Certified to Technical Regulation CU 012/2011 for use in potentially explosive atmospheres and marked 2Ex nA IIC T3 Gc X (without position sensor) or 2Ex d e nA IIC T3 Gc X (with position sensor) for electrical and II Gc TX for non-electrical portions of the valve.

EAC Customs Union (Marked): Certified to Technical Regulation CU 032/2013 on the safety of equipment operating under excessive pressure for 6-inch valves.

EAC Customs Union: Declared to Technical Regulation CU 032/2013 on the safety of equipment operating under excessive pressure for 2, 3, and 4-inch valves.

EAC Customs Union: Declared to Technical Regulation CU 010/2011 on the safety of machinery and equipment. Declared to Technical Regulation CU 020/2011 on Electromagnetic Compatibility of Technical Equipment.

Korean Certification (KC Mark): KCs Certificate No. 16-KA4BO-0387X (LELA)
KCs Certificate No. 22-KA4BO-0286X (LELA2)
Applicable Safety Certification Notice No. 2021-22
Installation of explosion proof equipment must comply with KS C IEC 60079-14
In relation to maintenance and repair, there is a limit of responsibility of the user and the manufacturer, such as the method and subject.

North American Compliance
These listings are limited only to those units that bear the appropriate marking.

CSA (LELA): CSA Certified for Class I, Div. 2, Groups A, B, C & D, T3 at 80°C Ambient with Position Sensor, 93°C without Position Sensor; For use in Canada and the United States, Certificate 1635932.
Actuator is certified for North America as on-systems engine component connected to the certified Digital Valve Positioner. This certificate does not cover the performance evaluation of the valves attached to the actuator.

ETL (LELA 2): Intertek-ETL certified for Class I, Div. 2, Groups A, B, C & D, T3 at 80°C Ambient with Position Sensor, 93°C without Position Sensor; For use in Canada and the United States.

Intertek
Control Number 5012634
Conforms to UL STDS 121201 & 429
Certified to CSA STDS C22.2 No. 213 & 139
This certificate does not cover the performance evaluation of the valves attached to the actuator.

SIL Compliance:

Large Electronic Sonic Valve (LESV II) – Certified SIL 3 Capable for Shutoff Function in safety instrumented systems. Evaluated to IEC 61508 Parts 1-7. Refer to the instructions of this installation and operation manual, Chapter 6 Safety Management.
SIL Certificate Product Certificate Number: WOO 1707039 C001

Special Conditions for Safe Use:

LESV II with LELA actuator is only suitable for use with the Woodward DVP1200 or DVP5000. LESV II with LELA2 actuator is to be powered by the Woodward DVP12000, suitably certified for the intended area of use.

Mating electrical connectors must be tightly installed on the actuator to maintain the IP55 rating. Appropriate caps must be in place for any unused connectors.

LELA2: Use supply wires suitable for at least 125°C. LELA: Use supply wires suitable for 10°C above surrounding ambient.

Maximum ambient temperature is 93°C for models without the optional SIL2 flow sensor, 80 °C for units with the SIL2 flow sensor.

LELA valve-actuator interface temperature must not exceed 141 °C. LELA2 valve-actuator interface temperature must not exceed 110 °C for models certified to 93 °C ambient, or 94 °C for models certified to 80 °C ambient. Valves fitted to the actuator by Woodward meet these requirements when installed with piping insulation as shown in the user manual.

T3 reflects conditions without process fluid. The surface temperature of this valve approaches the maximum temperature of the applied process media. It is the responsibility of the user to ensure that the external environment contains no hazardous gases capable of ignition in the range of the process media temperatures.

Compliance with the Machinery Directive 2006/42/EC noise measurement and mitigation requirements is the responsibility of the manufacturer of the machinery into which this product is incorporated.

⚠WARNING

EXPLOSION HAZARD – Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is non-hazardous.

Substitution of components may impair suitability for Class I, Division 2, or Zone 2.

Chapter 1.
General Information

Introduction

The Large Electric Sonic Valve (LESV II) controls the flow of gas fuel to the combustion system of an industrial or utility gas turbine. The LESV II is an extension of the HR-LESV product line and provides increased fuel pressure and temperature capabilities.

The integral electric actuator consists of a brushless DC motor and gear train which drives a precision lead screw for precise linear positioning. Dual resolvers are provided for motor commutation and position sensing. The actuators include a return spring for fail-closed operation. The LESV II includes a high temperature memory device (ID Module) which contains all the configuration and calibration information to be read by the Digital Valve Positioner (DVP) when the valve/actuator is connected and powered up. A soft stop cushion within the actuator is provided to protect the gear train and lead screw from damage when the actuator impacts the seat during trip events.

This valve is intended to operate only with specific models of the Woodward DVP. Refer to manual 26773 for specifications and additional information on the operation and configuration of the DVP5000 and DVP12000 (DVP5K and DVP12K). Contact your Woodward sales associate for part numbers for your specific applications.

Standard versions are compatible with most gaseous fuels, including natural gas, propane, ethane, methane, and up to 50% hydrogen by volume. An optional model is available that is compatible with pure gaseous hydrogen and must be used for any blends with more than 50% hydrogen by volume. This optional version may be suitable for unusually corrosive applications as well. All versions are designed to be ISO 17945/NACE MR0103 compliant. Contact your Woodward sales associate for more information. Note: Woodward defines pure hydrogen as 99.999% by volume.

Historically, the LESV II was available with an optional position feedback sensor for a SIL2 lightoff flow function. As of May 2023, this option is no longer available. See information in the following chapters for additional details.

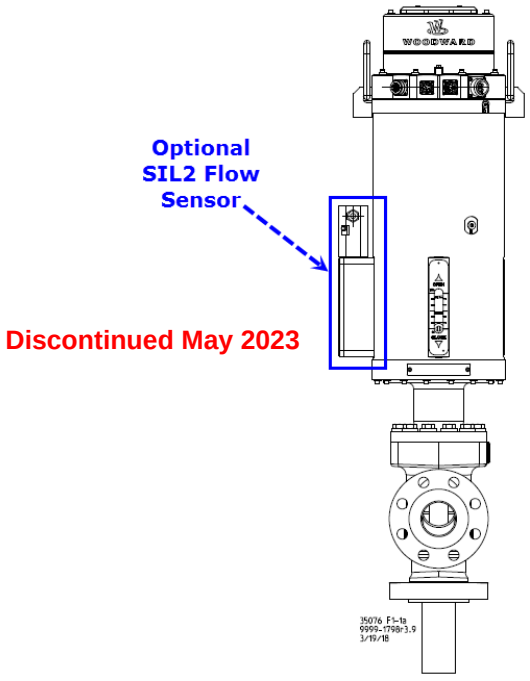
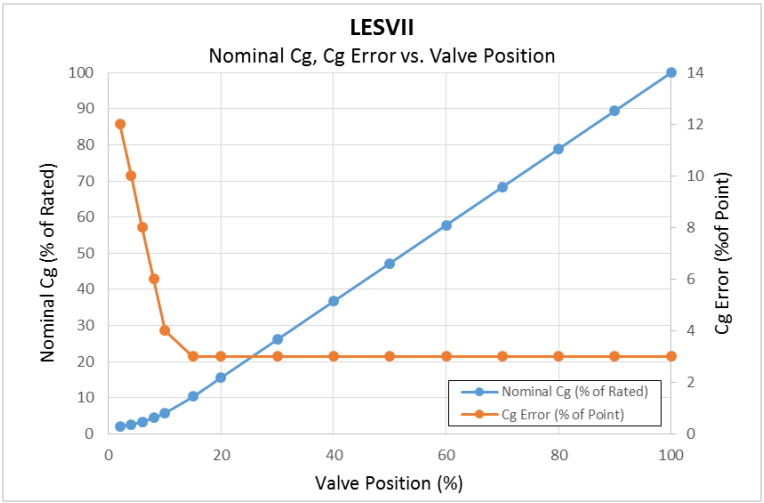


Figure 1-1. Optional SIL2 Flow Sensor 3, 4, 6-Inch LESV II

Table 1-1. LESV II Large Electric Sonic Valve Specifications

	2-Inch Using LELA Actuator	3, 4, & 6-Inch Using LELA2 Actuator
Description	2, 3, 4, & 6-inch (51, 76, 102, 152 mm) electrically actuated natural gas sonic metering valve.	
Mean Time Between Failure (MTBF)	100,000 hours of operation Combined metering valve/actuator/DVP/cable subsystem.	
Service Interval	Contact Woodward for recommended service interval.	
Ambient Temperature Range	-29 to +93 °C (-20 to +200 °F) for models without SIL2 Flow Sensor -29 to +80 °C (-20 to +176 °F) for models with SIL2 Flow Sensor	
Storage Temperature Range	-40 to +93 °C (-40 to +200 °F)	
Approximate Weights	2-inch: 119 kg / 263 lb.	3-inch: 259 kg / 571 lb. 4-inch: 299 kg / 659 lb. 6-inch: 375 kg / 827 lb.
ACTUATOR		
Description	Brushless DC motor with dual position feedback sensors.	
Motor Coil Insulation Rating	Class H	
Failure Mode	Spring type to drive valve to safe position with loss of signal (Fail Close).	
Bandwidth	2-inch LESV II: 35 rad/s with no more than 6 dB attenuation and less than 180° phase loss at ±2% magnitude and minimum supply voltage at DVP.	3-inch and 6-inch LESV II: 30 rad/s with no more than 6 dB attenuation and less than 180° phase loss at ±2% magnitude and minimum supply voltage at DVP.
Visual Position Indication	Yes	
Ingress Protection	IP55	
SIL2 Position Sensor	Discontinued May 2023	
SIL2 Position Sensor Input Voltage	20.4 - 28.8 VDC	
SIL2 Position Sensor Output Signal at 0 % Travel	(3.9 to 4.3) mA (not including thermal effects)	
SIL2 Position Sensor Output Signal at 100 % Travel	(9.5 to 9.85) mA (not including thermal effects)	(19.0 to 19.7) mA (not including thermal effects)
Actuator Response Time (measured from 90%-10% on a 100%-0% step)	2-inch: 400 mSec maximum	3, 4, 6-inch: 650 mSec maximum
DVP Model	2-inch LESV II: DVP5000	3, 4, & 6-inch LESV II: DVP12000
DVP Input Voltage: Typical Max Min (for full dynamic performance)	 220 VDC 300 VDC 112.5 VDC	 220 VDC 300 VDC 190 VDC
DVP Input Current: Max Steady State[1] Max Transient[2]	 1.5 Amps 20 Amps for 1 second	 1.5 Amps 30 Amps for 1 second
DVP Output Current: Max Steady State[1] Max Transient[2]	 12 Amps 40 Amps	 25 Amps 40 Amps

Table 1-1. LESV II Large Electric Sonic Valve Specifications (cont'd.)

	2-Inch Using LELA Actuator	3, 4, & 6-Inch Using LELA2 Actuator
VALVE		
Standard Version	Natural gas*	
Optional Version	99.999% gaseous hydrogen	
Gas Filtration	25 µm absolute at 75 beta requirement	
Valve Flange Connection	Class 600 Flange per ANSI B16.5	
Valve Materials	Per ISO 17945/NACE MR0103	
Min Fluid Temperature	–29 °C (–20 °F)	
Max Fluid Temperature	371 °C (700 °F)	
Min Fluid Pressure	0 kPa (0 psig)	
Max Fluid Pressure	6585 kPa at 38 °C (955 psig at 100 °F) 6585 kPa at 260 °C (955 psig at 500 °F) per ANSI B16.5 for CF8M 5998 kPa at 371 °C (870 psig at 700 °F) per ANSI B16.5 for CF8M	
Proof Test Pressure/Production	14996 kPa / 2175 psig	
Burst Pressure	5x maximum operating pressure.	
Overboard Leakage	< 25 cm³/min as shipped (see Fuel Overboard Vent Port section).	
Trim Sizes	Contact Woodward for various Cg trim sizes.	
Recovery Capability	1.06 P1/P2 Critical Choking Pressure Ratio Contact Woodward for additional details	
Seat Leakage	Class IV per ANSI/FCI 70-2	
Nominal Cg Curve, Cg Accuracy		

[1] Assumes slow modulation as when following a base load. Does not consider additional power required as seen in grid firming applications requiring continuous and fast ramping of power. If this is expected in the application, please contact Woodward for additional information. Stated current values are based on minimum DVP input voltage for full dynamic performance.

[2] Information provided for breaker and wire sizing. Current seen when performing a full 100% step against load. Note: this value varies by actuator type. The values above are applicable only for the products referenced in this manual. Stated current values are based on minimum DVP input voltage for full dynamic performance.

*Corrosive Fuels Recommendations

Woodward valves are designed to meet the full performance and lifetime specifications only when operated in an environment with less than 20 ppm H_2S. Woodward has no definitive performance experience for these valves operating above 20 ppm H_2S and therefore recommends an annual inspection along with a scheduled overhaul interval of no more than 20,000 operating hours or two years, whichever comes first. **This is a change to our normal recommendation for overhaul at 48,000 operating hours.** During overhaul the valve will be evaluated, and further recommendations can be provided which may include an update to the overhaul schedule.

NOTE: Regarding Atmospheric Environment, Woodward products are designed based on non-corrosive gas conditions. Besides particulates, the atmospheric environment may also contain corrosive gases such as hydrogen sulfide, sulfur dioxide, nitrous oxide, and chlorine. Product printed circuit assemblies are basically conformal coated with a specialized polyacrylate that provides protection from corrosive gaseous sulfur compounds and corrosion accelerants such as NOx and chlorine. By necessity, some areas cannot be coated—such as connectors, jumpers, test points, and field terminations. The larger conductor spacing, thicker metallization, and corrosion resistant plating of these uncoated areas will mitigate the effects of corrosion for a time but not prevent eventual damage.

The sulfur resistant coating will provide protection for coated components in moderately severe atmospheric environments as described by ISA S71.04-19852 level “G2”, and IEC 721-3-3 1994 TABLE 4 Class 3C2 (Urban Industrial, Heavy Traffic). See Tables 2 and 3 of Woodward Application Note 51530. Long-term use in more severe environments is not recommended because some critical reactive metal connection surfaces cannot be coated and corrosion will occur at a rate determined by the corrosive gas concentrations and mixtures, materials, temperature, and humidity.

LESV II Outline Drawings

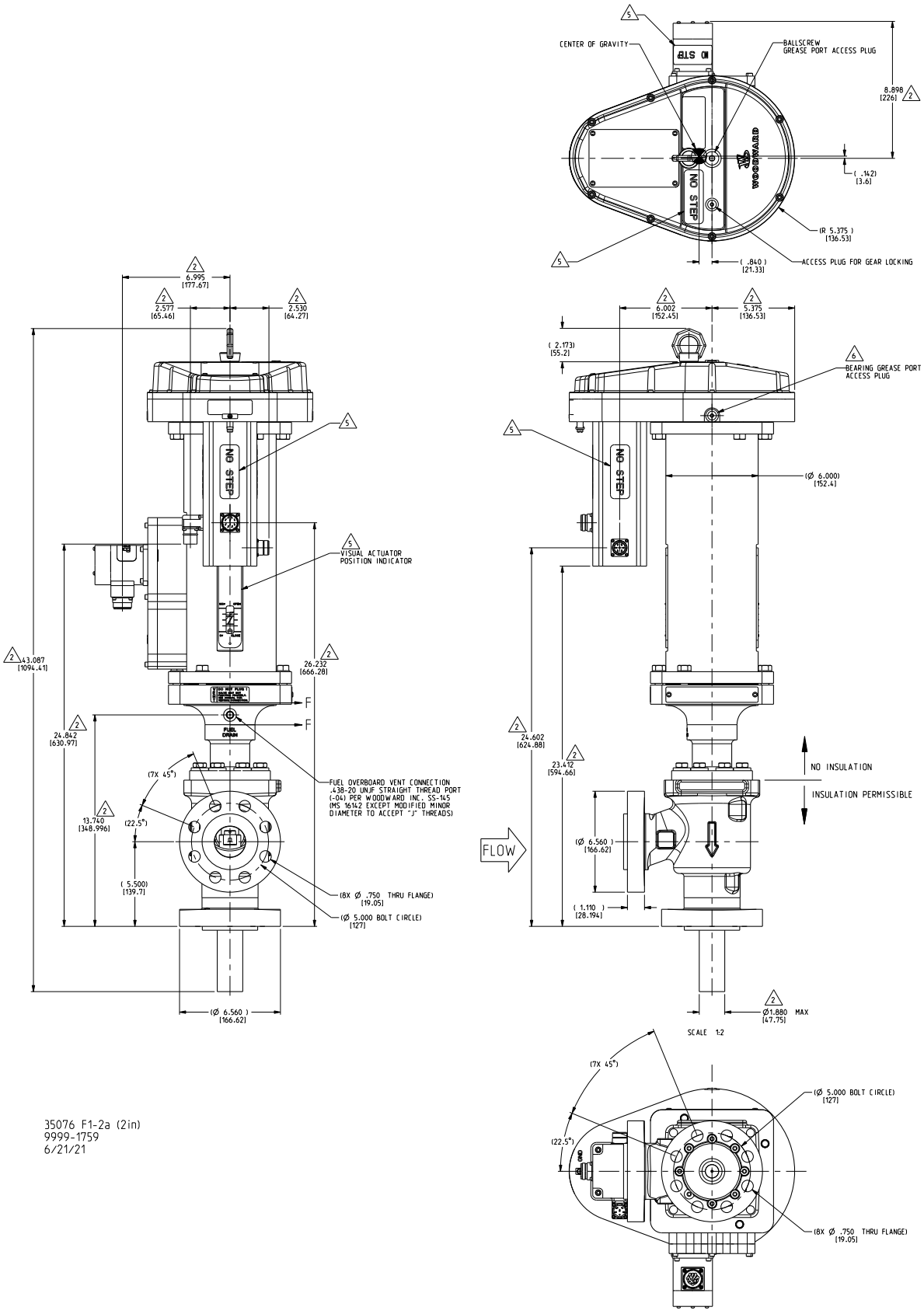


Figure 1-2a. Outline Drawing (2-Inch LESV II, UHR, SST, 600# Dual Resolver)

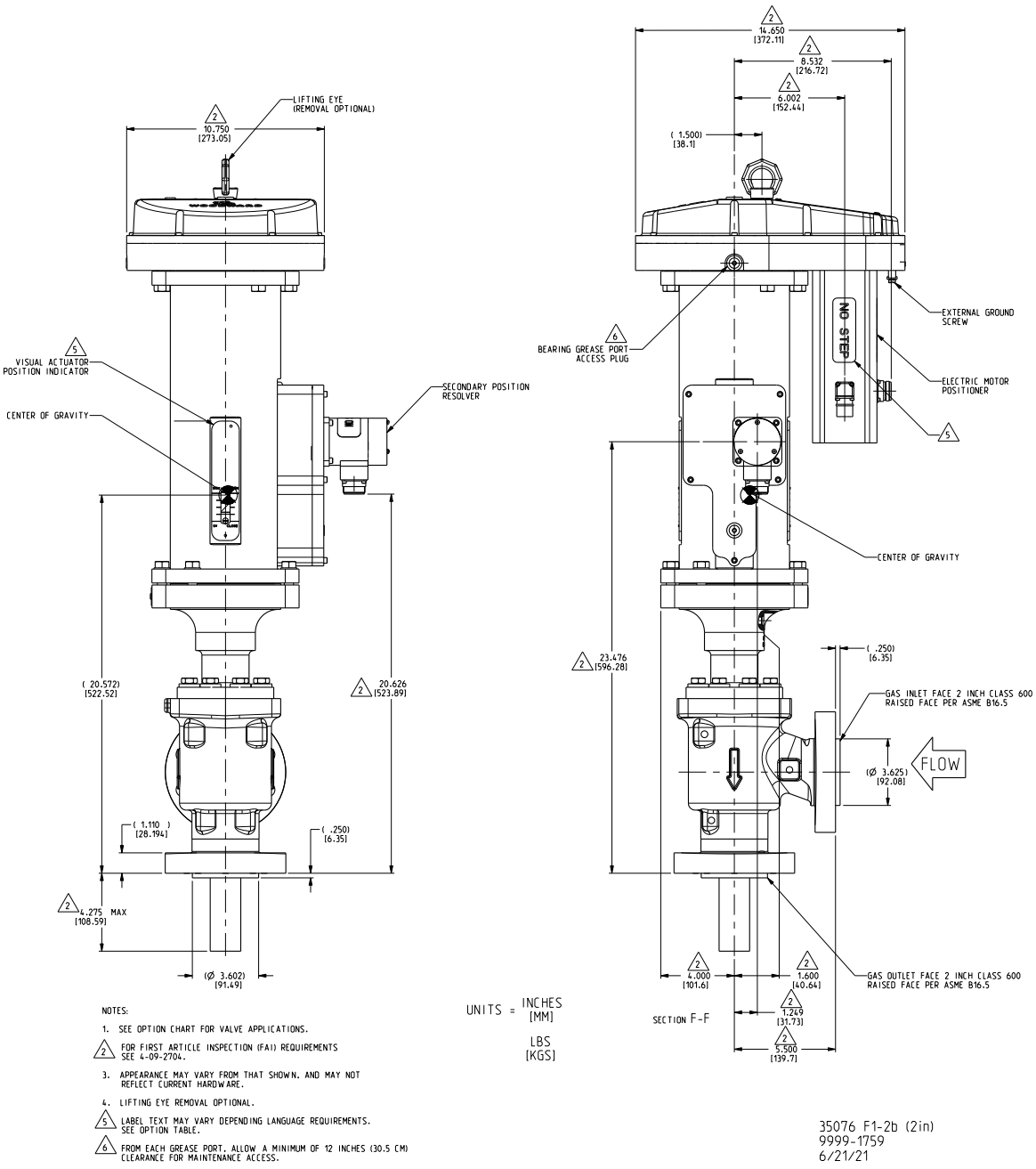
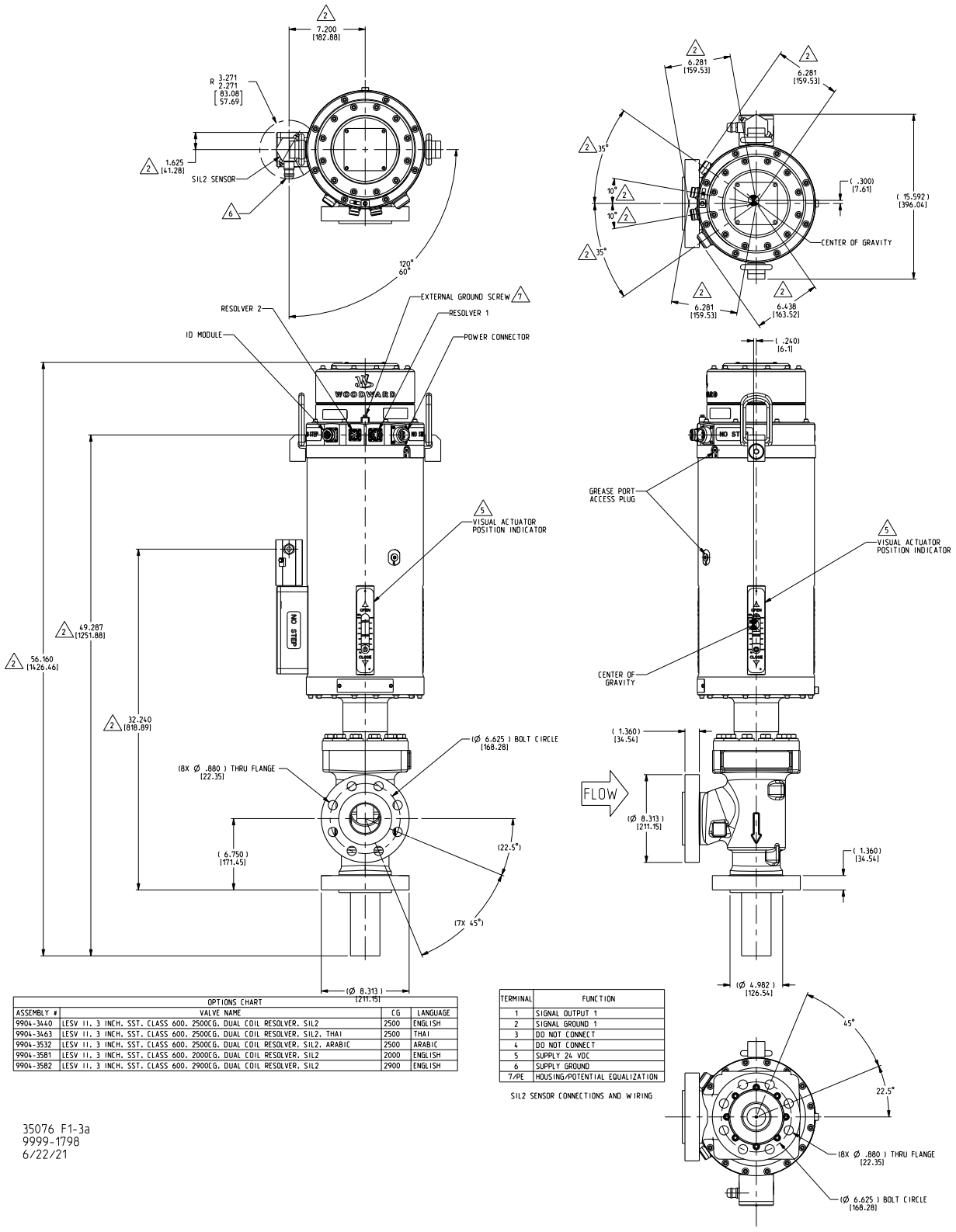


Figure 1-2b. Outline Drawing (2-Inch LESV II, UHR, SST, 600# Dual Resolver)



OPTIONS CHART

ASSEMBLY #	VALVE NAME	CG	LANGUAGE
9904-3440	LESV II, 3 INCH, SST, CLASS 600, 2500CG, DUAL COIL RESOLVER, SIL2	2500	ENGLISH
9904-3463	LESV II, 3 INCH, SST, CLASS 600, 2500CG, DUAL COIL RESOLVER, SIL2, THAI	2500	THAI
9904-3532	LESV II, 3 INCH, SST, CLASS 600, 2500CG, DUAL COIL RESOLVER, SIL2, ARABIC	2500	ARABIC
9904-3581	LESV II, 3 INCH, SST, CLASS 600, 2000CG, DUAL COIL RESOLVER, SIL2	2000	ENGLISH
9904-3582	LESV II, 3 INCH, SST, CLASS 600, 2900CG, DUAL COIL RESOLVER, SIL2	2900	ENGLISH

TERMINAL	FUNCTION
1	SIGNAL OUTPUT 1
2	SIGNAL GROUND 1
3	DO NOT CONNECT
4	DO NOT CONNECT
5	SUPPLY 24 VDC
6	SUPPLY GROUND
7/PE	HOUSING/POTENTIAL EQUALIZATION

SIL2 SENSOR CONNECTIONS AND WIRING

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Figure 1-3a. Outline Drawing (3-Inch LESV II Class 600)

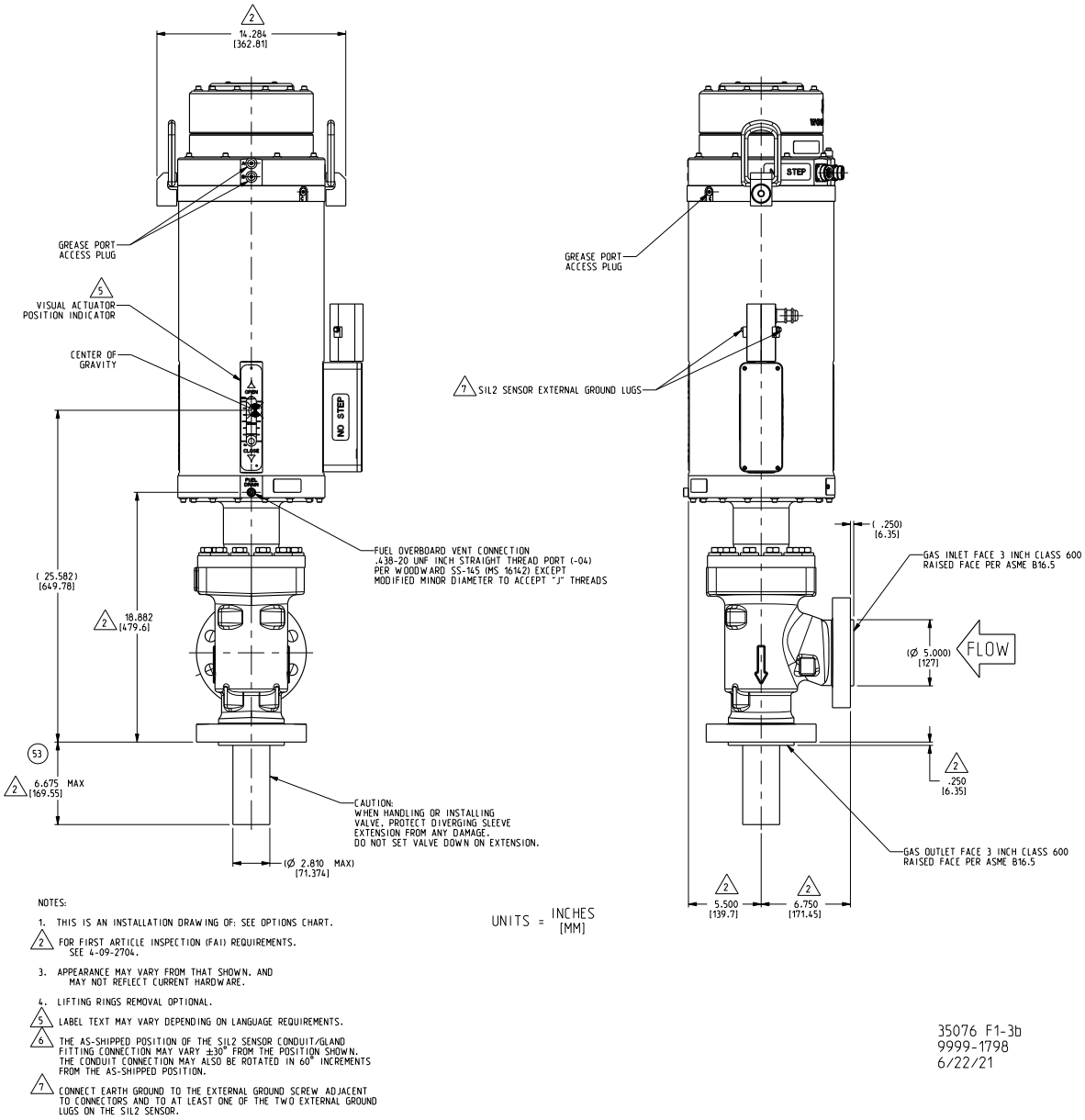
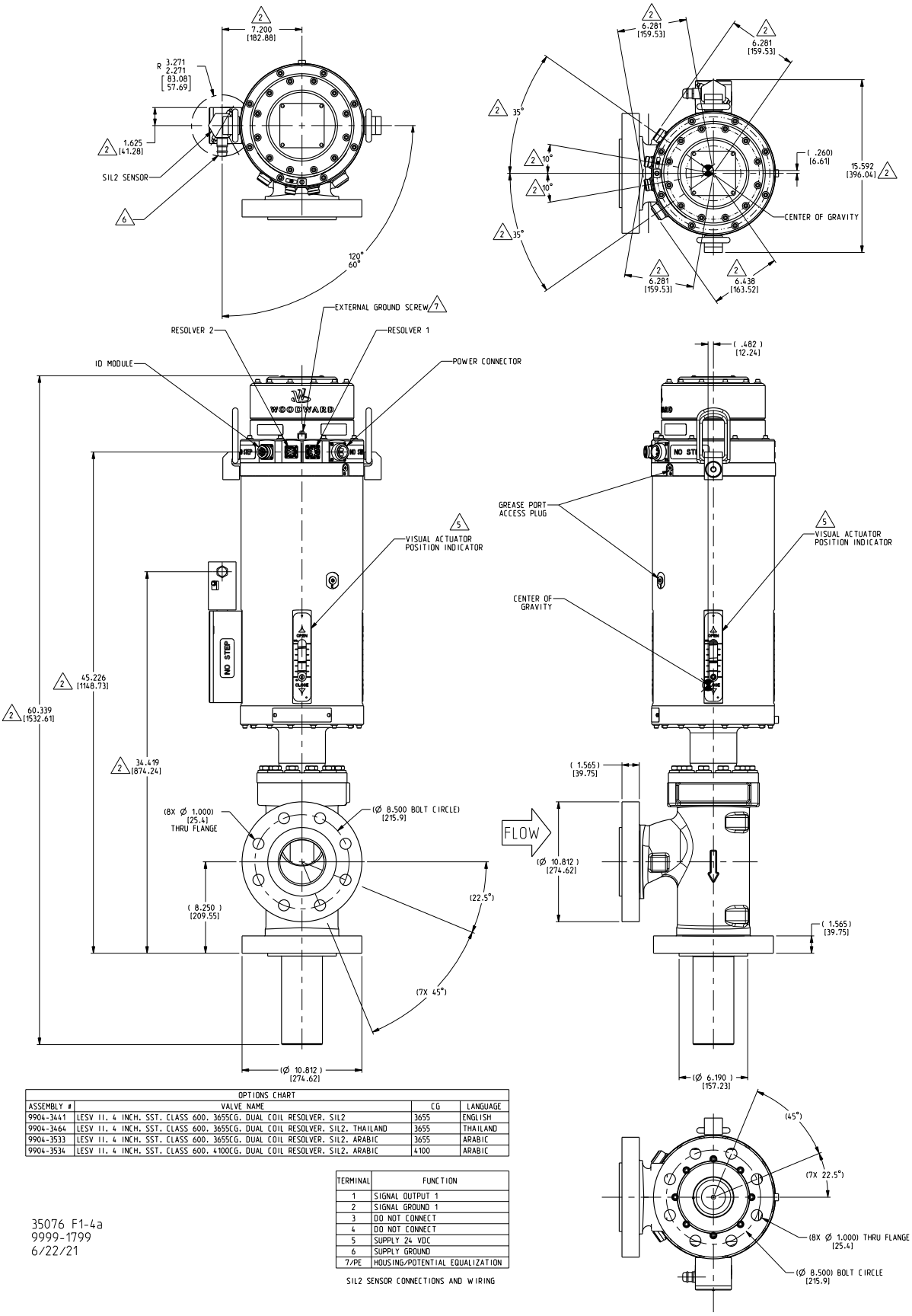


Figure 1-3b. Outline Drawing (3-Inch LESV II Class 600)



OPTIONS CHART			
ASSEMBLY #	VALVE NAME	CG	LANGUAGE
9904-3441	LESV II, 4 INCH, SST, CLASS 600, 3655CG, DUAL COIL RESOLVER, SIL2	3655	ENGLISH
9904-3464	LESV II, 4 INCH, SST, CLASS 600, 3655CG, DUAL COIL RESOLVER, SIL2, THAILAND	3655	THAILAND
9904-3533	LESV II, 4 INCH, SST, CLASS 600, 3655CG, DUAL COIL RESOLVER, SIL2, ARABIC	3655	ARABIC
9904-3534	LESV II, 4 INCH, SST, CLASS 600, 4100CG, DUAL COIL RESOLVER, SIL2, ARABIC	4100	ARABIC

TERMINAL	FUNCTION
1	SIGNAL OUTPUT 1
2	SIGNAL GROUND 1
3	DO NOT CONNECT
4	DO NOT CONNECT
5	SUPPLY 24 VDC
6	SUPPLY GROUND
7/PE	HOUSING/POTENTIAL EQUALIZATION

SIL2 SENSOR CONNECTIONS AND WIRING

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9999-1799
6/22/21

Figure 1-4a. Outline Drawing (4-Inch LESV II Class 600)

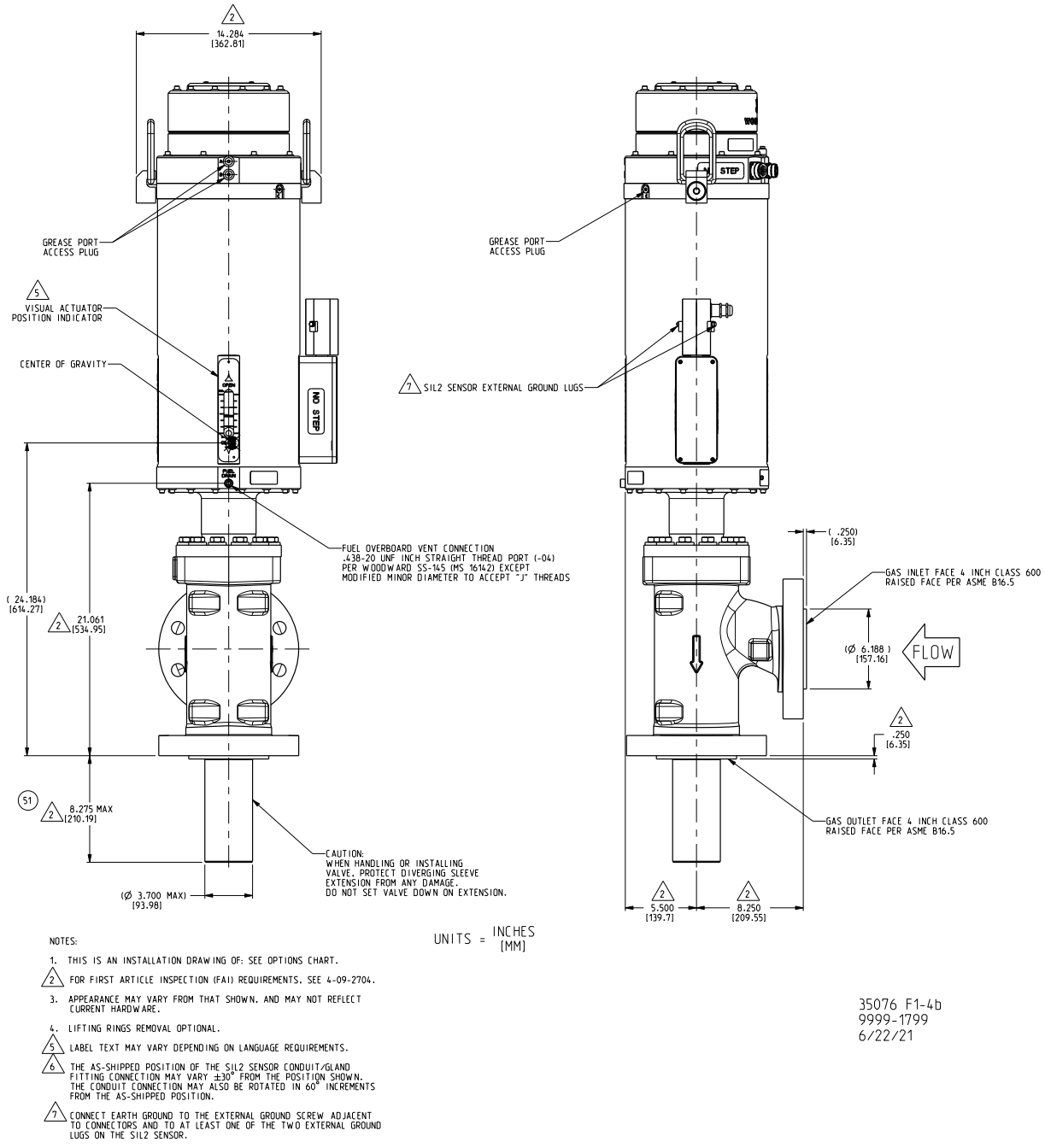
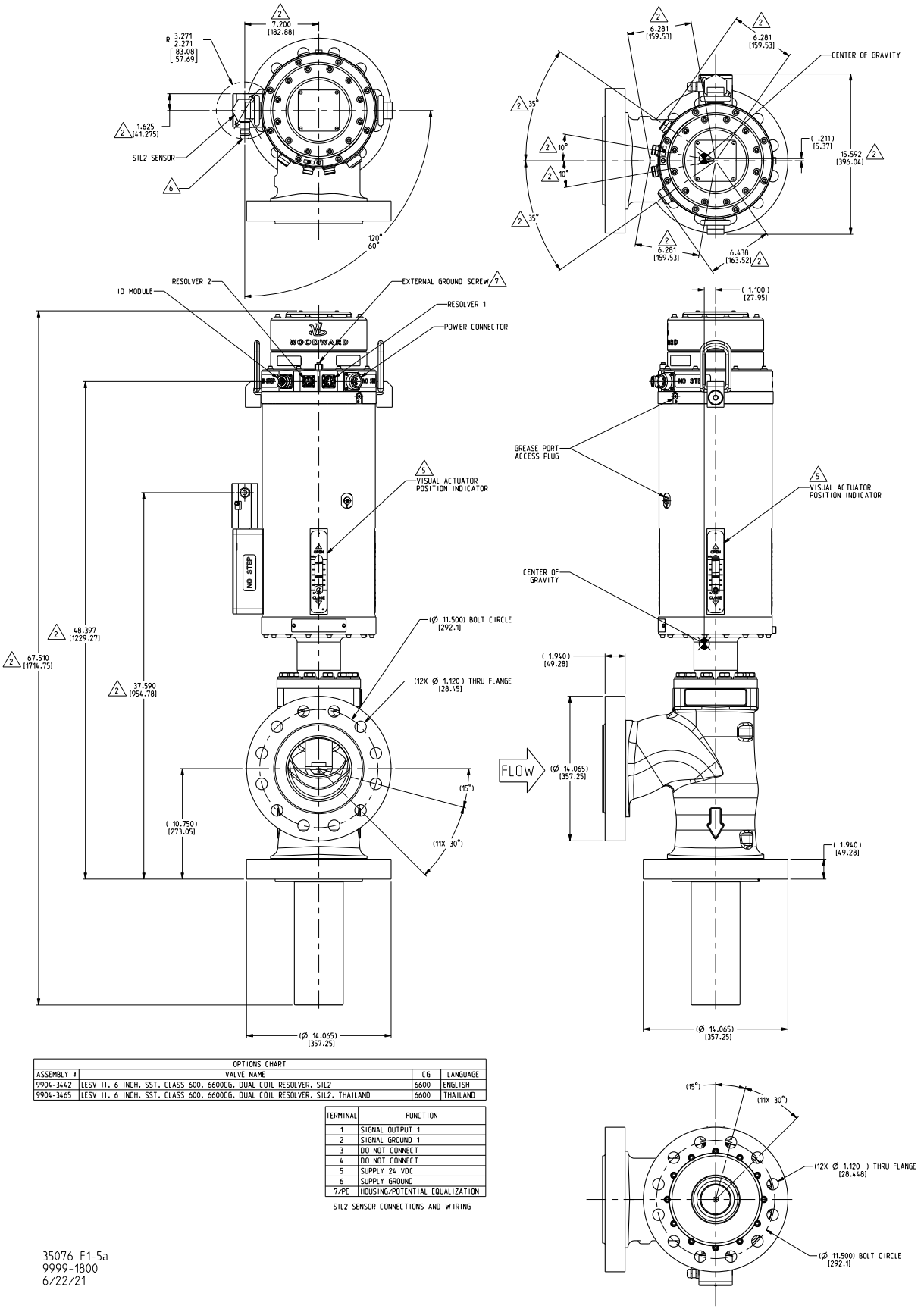


Figure 1-4b. Outline Drawing (4-Inch LESV II Class 600)



OPTIONS CHART

ASSEMBLY #	VALVE NAME	CG	LANGUAGE
9904-3442	LESV II, 6 INCH, SST, CLASS 600, 6600CG, DUAL COIL RESOLVER, SIL2	6600	ENGLISH
9904-3465	LESV II, 6 INCH, SST, CLASS 600, 6600CG, DUAL COIL RESOLVER, SIL2, THAILAND	6600	THAILAND

TERMINAL	FUNCTION
1	SIGNAL OUTPUT 1
2	SIGNAL GROUND 1
3	DO NOT CONNECT
4	DO NOT CONNECT
5	SUPPLY 24 VDC
6	SUPPLY GROUND
7/PE	HOUSING/POTENTIAL EQUALIZATION

SIL2 SENSOR CONNECTIONS AND WIRING

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9999-1800
6/22/21

Figure 1-5a. Outline Drawing (6-Inch LESV II Class 600)

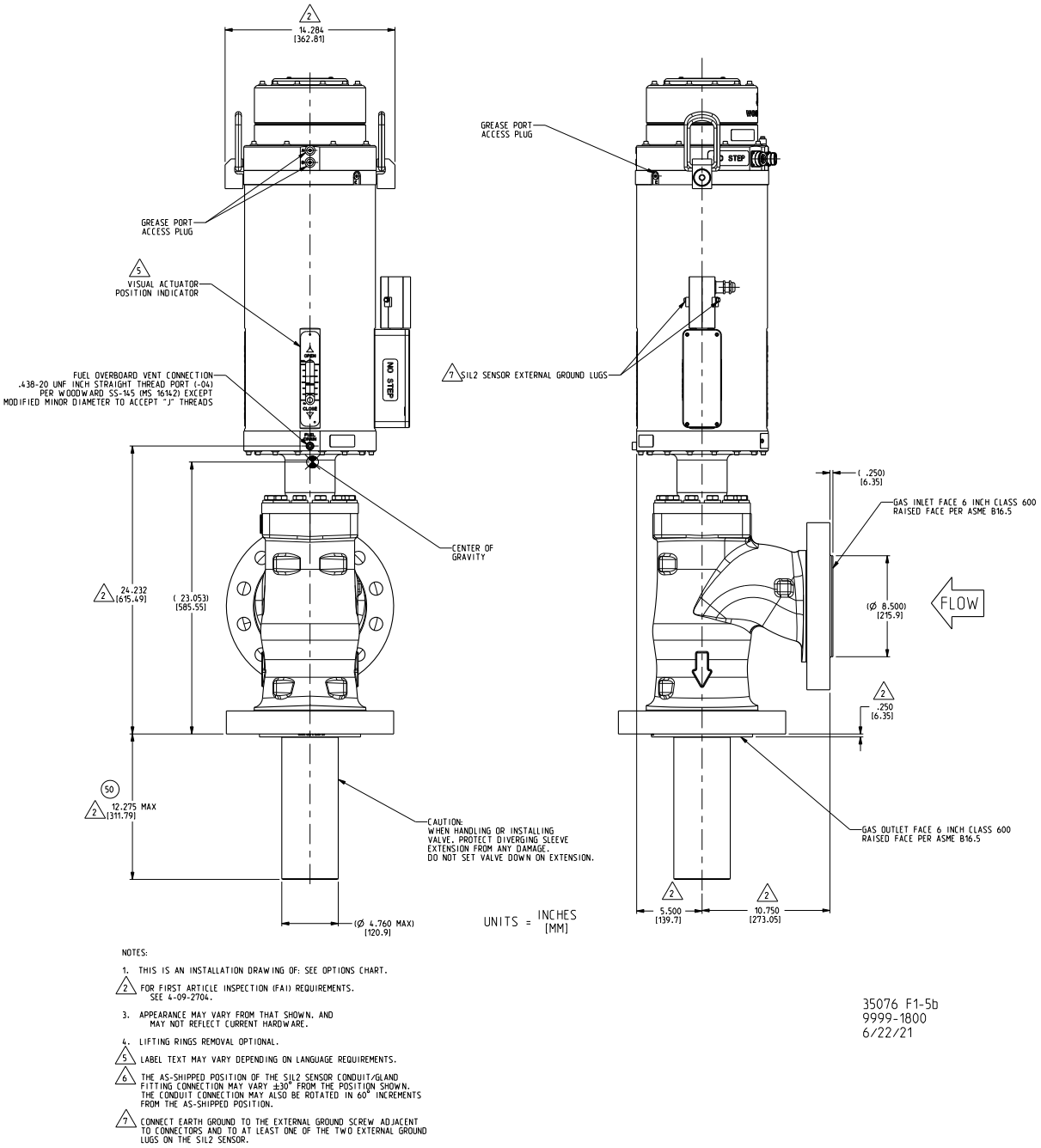

Figure 1-5b. Outline Drawing (6-Inch LESV II Class 600)

Connector Pinouts

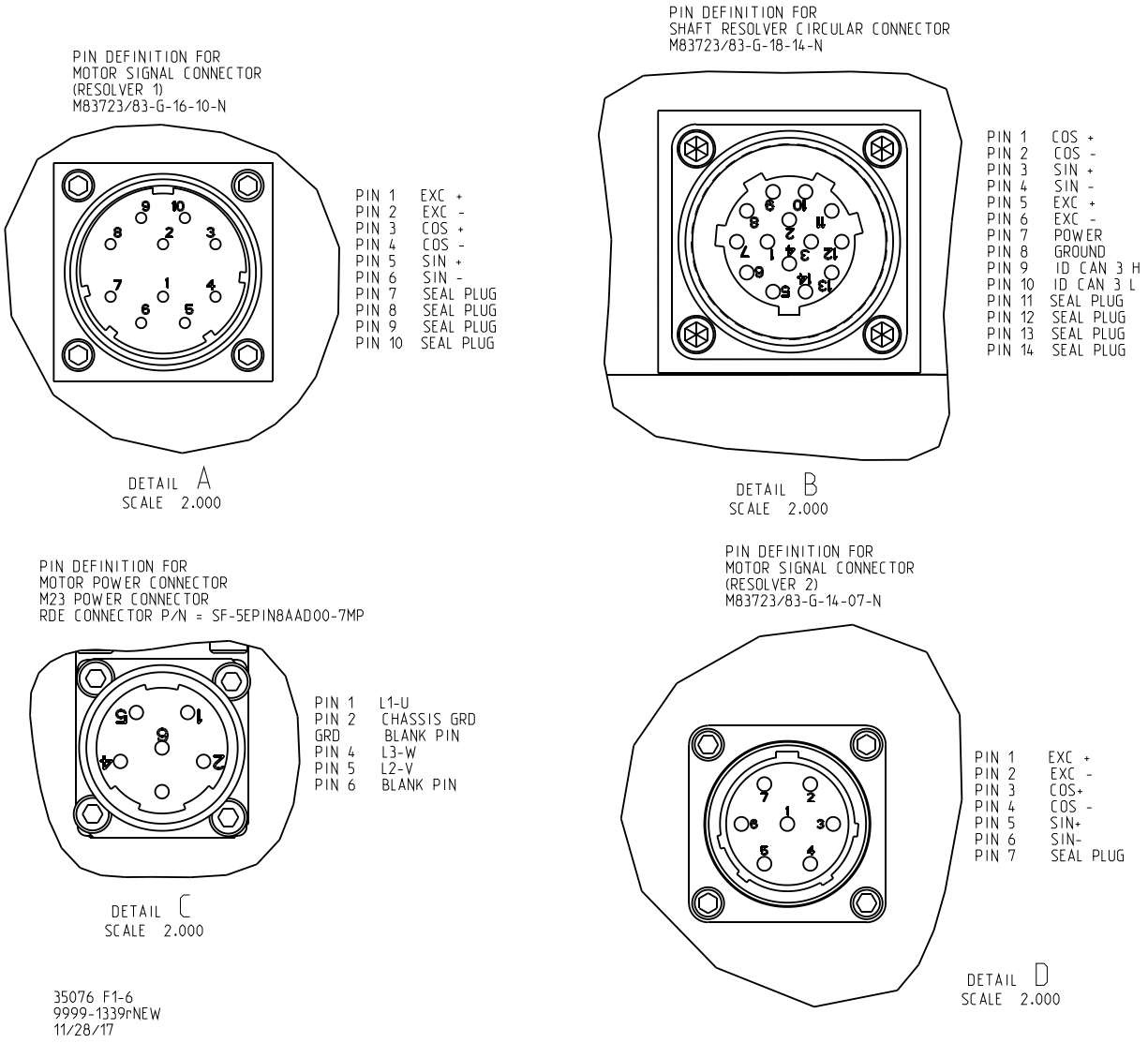

Figure 1-6. Connector Pin-outs – DVP5K with 2-Inch LESV II

Note: Connector key orientations shown above are for reference only. Refer to product outline drawing for product or part number specific key orientations.

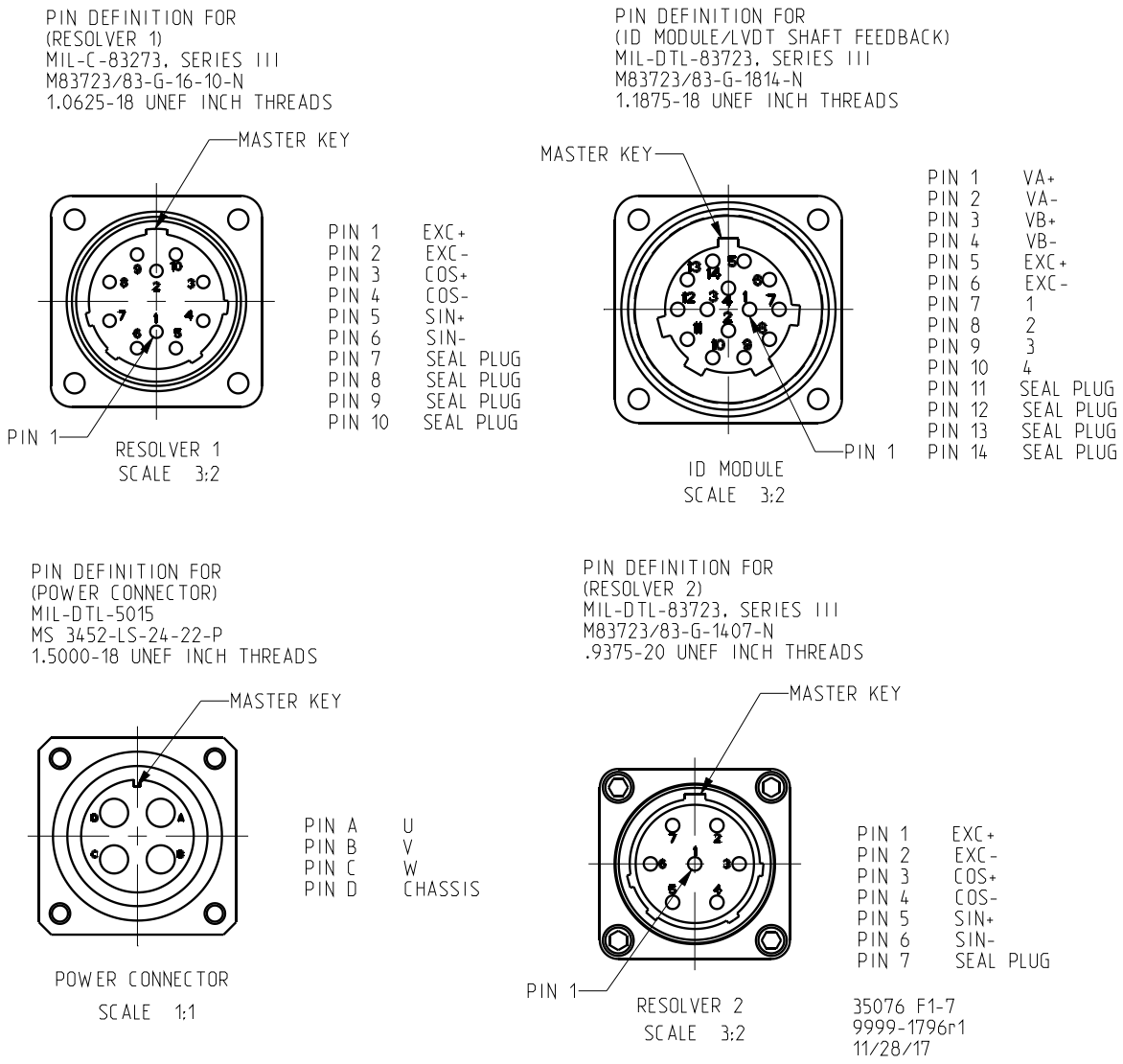

Figure 1-7. Connector Pin-outs – DVP12K with 3, 4, and 6-Inch LESV II

Note: Connector key orientations shown above are for reference only. Refer to product outline drawing for product or part number specific key orientations.

Table 1-2. SIL2 Sensor Wiring Connections

Terminal	Function
1	Signal Output 1
2	Signal Ground 1
3	Do Not Connect
4	Do Not Connect
5	Supply 24 VDC
6	Supply Ground
7/PE	Housing/Potential Equalization

Chapter 2.
Description

Actuator: Woodward LELA (Large Electrical Linear Actuator)

The LELA and LELA2 actuators consist of:

- A brushless DC motor that provides torque
- An integral resolver for motor commutation and position feedback to the controller
- A feedback device for motor resolver verification
- A magnetostrictive feedback sensor for SIL2 position (discontinued May 2023)
- A high-efficiency ball screw for rotary-to-linear motion conversion

The LELA and LELA2 actuators also contain:

- A fail-safe spring designed to extend the actuator if power is removed from the actuator
- A soft-stop spring to dissipate motor rotor inertia during fail-safe shutdown and prevent ball screw damage
- A cam follower to provide opposing torque during slew operations
- A lifting eye(s) to aid installation

Brushless DC Motor

The motor assembly used on the LELA2 is a permanent magnet, electrically commutated, brushless DC motor. The components used in the motor assembly are rated for service from –40 to +155 °C (–40 to +311 °F).

Resolver Position Feedback Sensors

The primary position feedback transducers are the dual redundant resolvers that are integral to the DC brushless motor assembly.

The 2” LESV II actuator (LELA) also has a valve stem resolver for secondary position feedback. This resolver is used as a watchdog function of the primary motor control, to prevent runaway conditions and to ensure that the primary motor resolver is reading correctly. Linear shaft motion is converted to angular rotation for the valve stem resolver through a linkage.

The 3”, 4”, and 6” LESV II actuator (LELA2) has a valve stem LVDT to provide secondary feedback.

Parameter files are loaded onto the DVP to specifically match the valve characteristics to obtain the most accurate position sensing.

Optional SIL2 Position Feedback Sensor

The optional position feedback sensor was discontinued in May 2023. This section is included as a reference for products built with the optional sensor prior to it being discontinued.

The LELA actuator is available with an optional magnetostrictive feedback sensor. The sensor is connected to the valve stem for a SIL2 lightoff flow function.

Electronically, the SIL2 sensor is connected only to the customer control system and is not connected to the Woodward DVP. The SIL2 sensor serves as a position indicator for valve position that is independent of the DVP and is used primarily to accurately control fuel flow during turbine light off.

The components in the SIL2 sensor are rated for service over a range of –40 to +93 °C (–40 to +199 °F). However, to meet the SIL requirements for component reliability, the LESV II ambient temperature range has been limited to –29 to +80 °C (–20 to +176 °F). Therefore, if at any time while the LESV II is in

service, the ambient temperature exceeds +80 °C, the sensor must be replaced. Refer to Chapter 4 for instructions for sensor replacement.

Soft Stop Spring

Integral to the actuator is a soft stop spring. This provides a bumper like action if the actuator is driven hard into the fully extended position. This will occur only on loss of power, certain wiring faults, and in rare cases, internal fault conditions within the positioner. The soft stop mechanism is not used when the positioner is controlling the actuator. Although the positioner will rapidly drive the actuator towards the minimum position, it also decelerates the actuator as the actuator approaches the mechanical minimum stop. Under the control of the positioner, the actuator should not reach the mechanical minimum stop at a high velocity.

Valve Portion: SonicFlo

The SonicFlo contoured plug valve consists of a valve housing, metering plug, diverging sleeve, pilot sleeve/bonnet, and actuator adapter. The metering elements of this valve are a contoured plug and a hardened seat. The plug is contoured to provide various Cg versus position flow characteristics from 0% to 100% stroke. Please contact Woodward for available trim sizes and Cg profiles.

LESV II Pressure Ratio Operational Limitations

For the 6-inch LESV II in trim sizes of 6600 and 7500 Cg only, if the inlet pressure to the valve exceeds 700 psig, the pressure ratio across the valve must fall within the allowable range as outlined in the chart below.

For all other trim sizes, there are no pressure ratio limitations up to the full rated pressure of 955 psig.

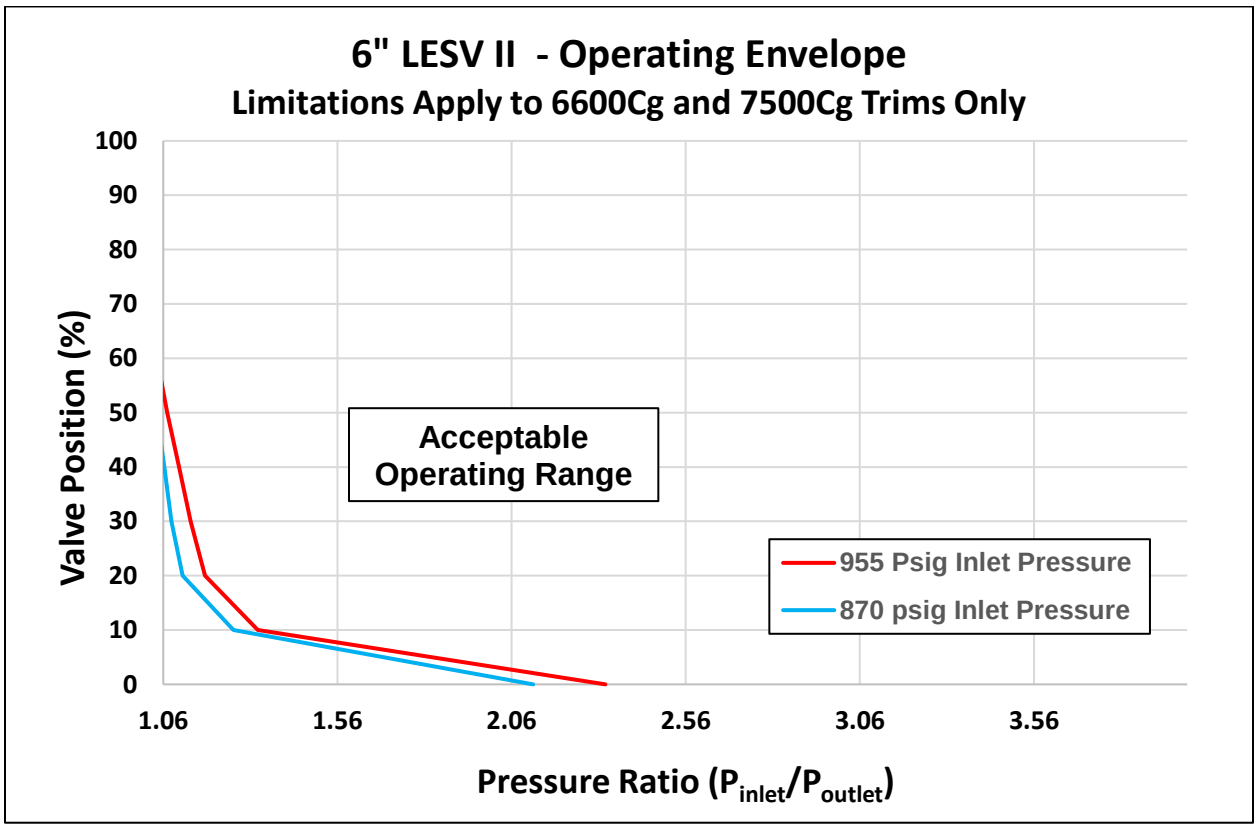

Figure 2-1. 6-Inch LESV II Operating Envelope

Chapter 3.
Installation

General

See the outline drawings (Figures 1-2 through 1-7) for:

- Overall dimensions
- Process piping flange locations
- Electrical connections
- Lift points and center of gravity

Installation attitude does not affect actuator or fuel valve performance, but a vertical position is generally preferred to conserve floor space as well as ease of making electrical and fuel connections. The LESV II is designed for support by the piping flanges alone; additional supports are neither needed nor recommended. Do not use this valve to provide support to any other component in the system. The piping should be aligned and adequately supported such that excessive piping loads are not transmitted to the valve body.

When the valve is flow tested at the factory, the lengths of inlet and outlet piping to the LESVII conform to ANSI/ISA-S75.02. To maintain the valve flow accuracy and recovery performance in the application, it is recommended that the installation piping lengths meet ANSI/ISA-S75.02.

⚠WARNING

EXPLOSION HAZARD—The surface temperature of this valve approaches the maximum temperature of the applied process media. It is the user's responsibility to ensure that the external environment does not contain hazardous gases capable of ignition in the range of the process media temperatures.

⚠WARNING

Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the LESV. Noise levels greater than 90 dB are possible.

⚠WARNING

The surface of this product can become hot or cold enough to be a hazard. Use protective gear for product handling in these circumstances. Temperature ratings are included in the specification section of this manual.

NOTICE

External fire protection is not provided in the scope of this product. It is the responsibility of the user to satisfy any applicable requirements for their system.

Required Clearance for Lubrication Kit Syringes and Gun/Needle

For 2-inch LESV II grease ports, refer to Figure 3-1. For both ports indicated, leave a minimum of 12 inches (30.48 cm) clearance for maintenance access. See manual 35134 for additional lubrication details.

Figure 3-1. Grease Port Locations 2-Inch LESV II

For 3, 4, 6-inch LESV II grease ports, refer to Figure 3-2. For grease ports A-D, leave a minimum of 12 inches (30.48 cm) clearance for maintenance access. See manual 35103 for additional lubrication details.

For grease port E (the gun/needle): leave a minimum of 12 inches (30.48 cm) clearance for maintenance access. See manual 35103 for additional lubrication details.

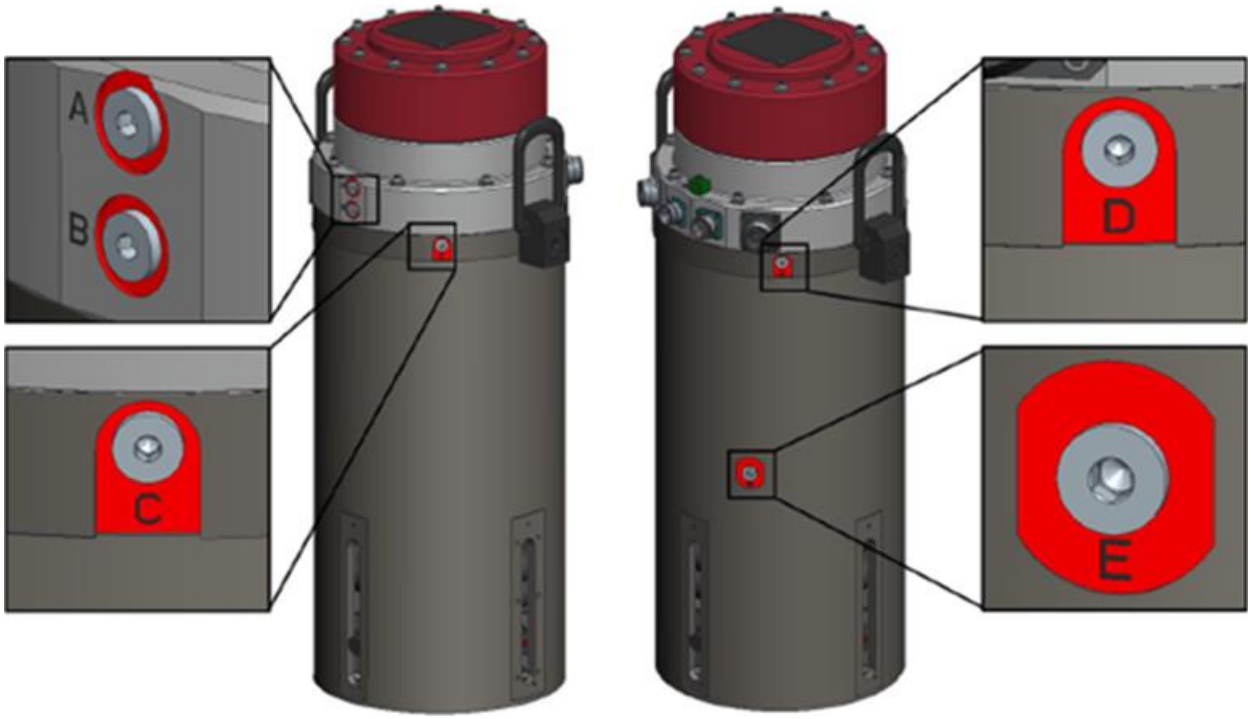

Figure 3-2. Port Locations 3, 4, and 6-Inch LESV II

Lifting Procedures

⚠WARNING

Crushing Hazard

Carefully review Figures 1-2a through 1-5b, and 3-3 and 3-4 for lifting locations, weight, and center of gravity before moving the LESV II. Do not lift or handle the actuator by electrical connections or the SIL2 Flow Sensor.

The significant weight of the valve poses a crushing hazard that can result in personal injury or death.

NOTICE

The LESV II is not designed to be a step or to support the weight of a person.

NOTICE

PROTECT ELECTRICAL CONNECTORS. If not properly protected, electrical connector damage can occur during lifting and installation of the LESV II.

While a single lifting eye is capable of supporting the weight of the LESV II, when lifting the valve from the vertical position, Woodward recommends lifting the LESV II by the two lifting eyes shown in Figure 3-3. The maximum lifting strap angle shown in Figure 3-3 is to prevent the lifting eyes and straps from rubbing against the motor housing.

When lifting the valve from the horizontal position, Woodward recommends lifting the LESV II as shown in Figure 3-4. It is permissible to lift the valve section by looping a choke strap around the valve housing. The maximum lifting strap angle shown in Figure 3-4 is to prevent overstress on the lifting eyes.

When lifting the valve from a horizontal position and transitioning to a vertical position, use caution to ensure the lifting straps do not make contact with, and potentially damage, the electrical connectors or motor housing. Also use caution to ensure no contact is made with the diverging sleeve extension while the valve is being transitioned to the upright position.

Figure 3-3. Vertical Lifting

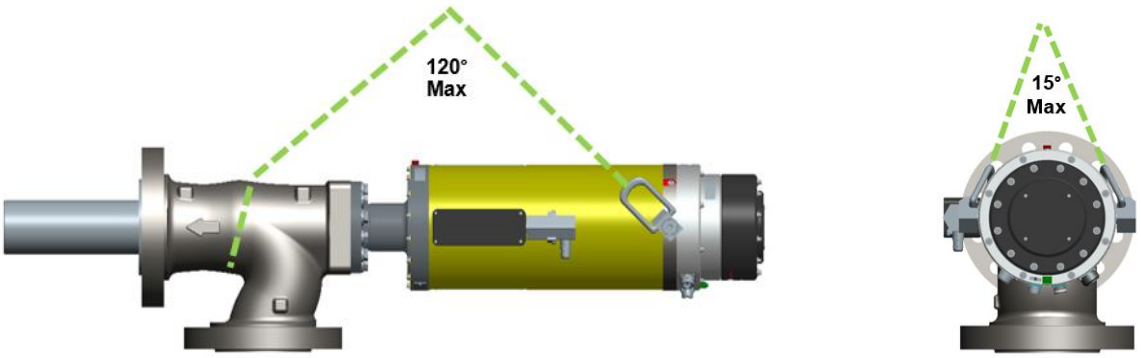

Figure 3-4. Horizontal Lifting

NOTICE

For the LESV IIs, the diverging sleeve extends past the outlet flange. Take care not to damage the sleeve extension. Do NOT use the extension to support the valve in any manner, either as a lifting point, or to set the valve on. If the sleeve is disturbed, basic valve functionality such as seat leakage or flow performance may be adversely affected.

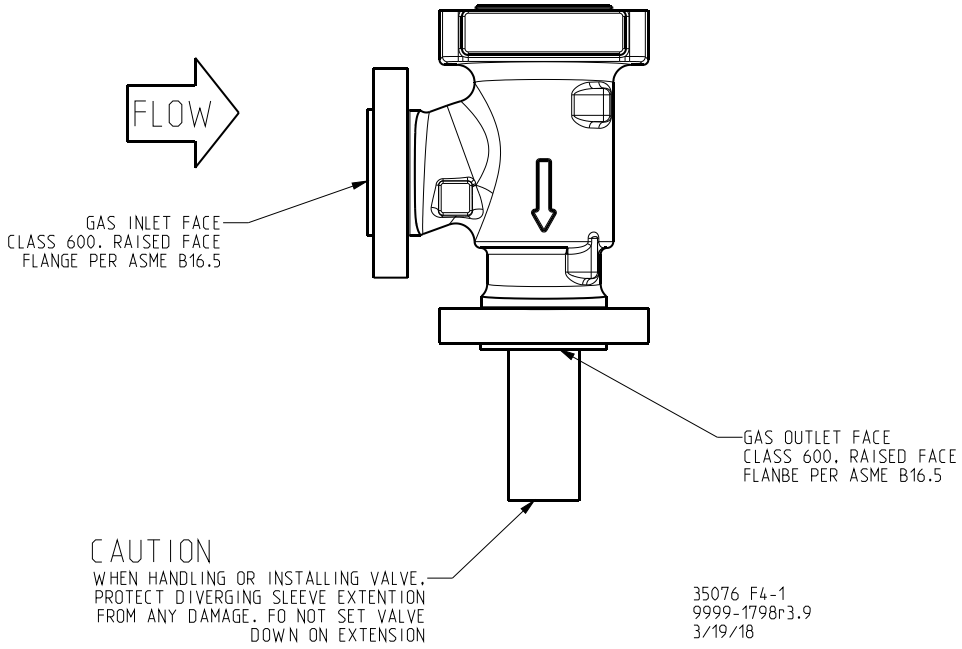

Figure 3-5. Representative Outline of LESV II

In addition, if performing any functional or pressure testing of an LESV II, the valve discharge flange must first be properly supported by mounting either a flange cap or equivalent spool pipe and blind flange to the valve discharge flange. The diverging sleeve is held in place by a series of screws that are for shipping purposes only. These screws are not sufficient to support the sleeve during functional testing (i.e., trip test or pressure testing). Refer to the following Piping Installation section for proper bolting and gasket guidelines.

⚠WARNING

Do not operate the valve without proper support for the diverging sleeve. The diverging sleeve can only be properly supported by bolting and properly torquing the outlet flange to either piping or an equivalent flange. Do not place hands inside the valve body during inspection, cleaning, or operation.

NOTICE

If pressure testing is being performed on the LESV II, the actuator must be connected to the DVP, powered up, and under position control.

If the unit is unpowered during a pressure test, the actuator return spring force alone may be insufficient to prevent the valve from moving open, and potential damage to the LELA II actuator could result.

Figure 3-6. Support Flange Bolted to Outlet Flange

Piping Installation

Refer to ANSI B16.5 for details of flange, gasket, and bolt types and dimensions.

The LESV II is designed for support by the piping flanges alone; additional supports are neither needed nor recommended.

The LESV II is a 90° angle valve. Verify that the process piping face-to-face dimensions meet the requirements of the outline drawings (Figures 1-2 through 1-5) within standard piping tolerances. The valve should mount between the piping interfaces such that the flange bolts can be installed with only manual pressure applied to align the flanges. Mechanical devices such as hydraulic or mechanical jacks, pulleys, chain-falls, or similar equipment should never be used to force the piping system to align with the valve flanges.

ASTM/ASME grade bolts or studs should be used to install the valve into the process piping. The length and diameter of the bolts and studs shall conform to ANSI B16.5 according to the valve flange size and class.

Flange gasket materials should conform to ANSI B16.20. The user should select a gasket material which will withstand the expected bolt loading without injurious crushing, and which is suitable for the service conditions.

When installing the valve into the process piping, it is important to properly torque the studs/bolts in the appropriate sequence to keep the flanges of the mating hardware parallel to each other. A two-step torque method is recommended. Once the studs/bolts are hand-tightened, torque the studs/bolts in a crossing pattern to half the required torque. Once all studs/bolts have been torqued to half the appropriate value, repeat the pattern until the rated torque value is obtained.

Piping loads that can be considered “typical” have been used in the design of the housing to ensure that there is not an adverse effect from the stresses applied to the housing from the inlet and outlet piping. The loads, which were used in the design of these housings, are (and should not be exceeded):

Table 3-1. Piping Loads According to Valve Size

Valve Size	Max Pipe Axial Force	Max Pipe Shear Force	Max Pipe Moment	Max Flange Bolt Force (per bolt)
50 mm (2 inch)	3600 N (809.3 lbs.)	3600 N (809.3 lbs.)	2200 N-m (1622.6 lb.-ft)	29016 N (6523 lbs.)
80 mm (3 inch)	5400 N (1214 lbs.)	5400 N (1214 lbs.)	3300 N-m (2434 lb.-ft)	40301 N (9060 lbs.)
100 mm (4 inch)	7200 N (1618 lbs.)	7200 N (1618 lbs.)	4400 N-m (3245.3 lb.-ft)	65634 N (14755 lbs.)
150 mm (6 inch)	11000 N (2472.9 lbs.)	11000 N (2472.9 lbs.)	6600 N-m (4867.9 lb.-ft)	78587 N (17667 lbs.)

The valve and the valve inlet/outlet piping may be insulated. If the valve is insulated, the insulation cannot extend beyond the valve body. The valve bonnet and actuator are not to be insulated, otherwise the valve and/or actuator components may exceed their rated temperatures. See Figure 3-7.

It is also permissible to leave the valve body un-insulated.

The valve discharge flange must not exceed 371 °C (700 °F) when the valve is closed, and the downstream circuit is being purged.

⚠WARNING

When welding near the LESV II, disconnect all cables, and verify the actuator chassis is grounded prior to beginning welding operations.

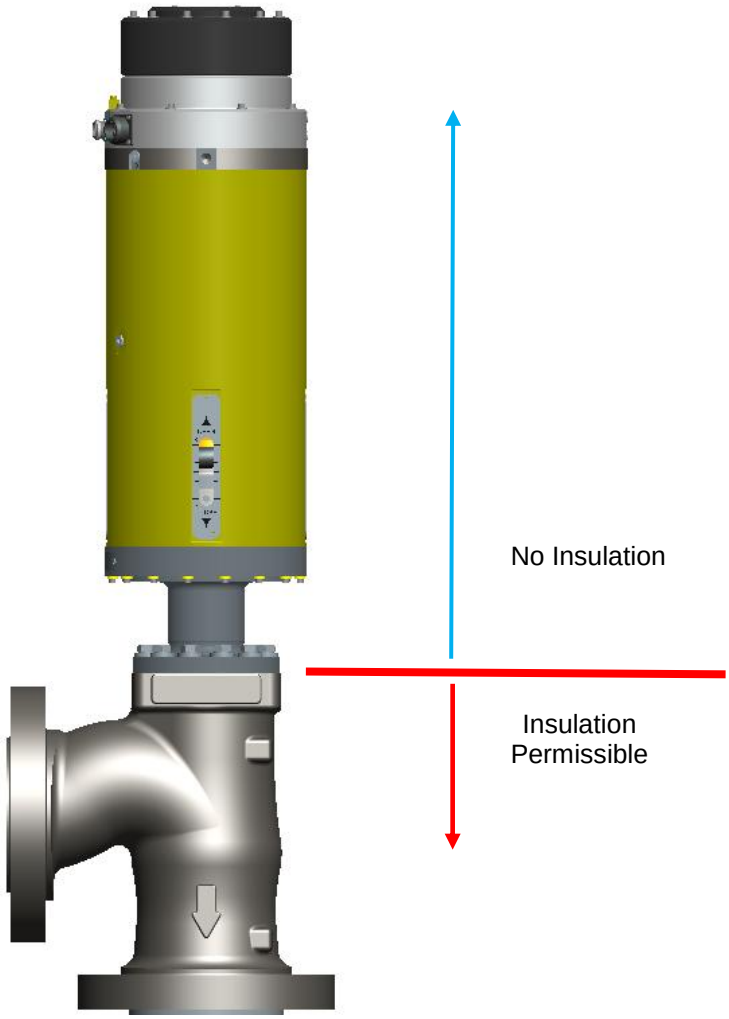

Figure 3-7. Valve Insulation

Fuel Overboard Vent Connection

There is a fuel overboard vent port that must be vented to a safe location. In normal operation, this vent should have very low leakage.

NOTICE

Never plug the fuel overboard vent port, which could cause the valve to malfunction or to operate improperly.

Valve Characteristic Data

Flow testing is conducted on every valve before shipment. Results from this flow testing produce Cg versus position characteristics of the valve. Each valve must demonstrate predetermined Cg characteristics before it can be shipped.

Calibration

The actuator and controller perform an automatic rigging procedure. When the actuator controller is activated, it performs an automatic rigging procedure that checks system health and verifies the value is in the proper position. No additional steps are required from the operator.

Valve/Actuator Configuration Settings

The LESV II utilizes a device (ID Module) containing all the configuration and calibration information that is read by the Digital Valve Positioner (DVP) when the valve/actuator is connected and powered up. Initial configuration settings for the valve/actuator do not need to be entered into the DVP due to the ID Module communicating directly with the positioner. However, in the unlikely event the configuration settings must be entered manually, the following tables outline the necessary configuration settings for the LESV II. These configuration settings are distributed into three groups: User Configuration Parameters, Valve Part Number Specific Parameters, and Valve Serial Number Specific Parameters. Some of the configuration settings include factory calibration information. Please contact Woodward with the valve part number and serial number for the data containing the specific calibration and configuration settings if the need arises. Many of these parameters are accessible via the Woodward Service Tool.

User Configuration Parameters

The User Configuration Parameters are used in the DVP to define the interface between the DVP and the turbine control system. Examples of these include the demand type selection, analog input scaling, discrete input, and output configurations, etc. For a complete description of all the options for the User Configuration Parameters, please see the DVP product manual.

Valve Part Number Specific Parameters

These parameters define the settings based on a particular valve type (part number). Every valve of the same type, regardless of serial number, will have the same settings. Please refer to the table below for a definition of these settings. For instructions on how to enter these values, please refer to the DVP manual.

NOTICE

Please contact Woodward for the correct settings for your application.

Table 3-2. Valve Part Number Specific Parameters

Parameter Name	Description	Value/Units
ValveTypeId		
IdModuleVersion	Parameter set version	1 = Rev 0 2 = Rev 1, etc.
ValveType	Selects valve type	56 = 1.5-Inch Stroke LESV II (2-Inch valve) 64 = 3- Inch Stroke LESV II (3, 4, 6-Iinch valves)
ValveProductCode	Upper level part number of valve assembly	9904-XXXX (See applicable part number)
ValveProductRev	EC Revision of Valve Assembly	1 = NEW 2 = A 3 = B, etc. 100 = Rev 0 101 = Rev 1, etc.
BLDCPosStateParams		
MinCheckCurrent	Current to close valve during min startup check	amps
MaxCheckCurrent	Current to preload valve in opening direction during min startup check	amps
MotorDirectioncheckLimit	Min movement in the closing direction during startup check to avoid a motor direction error	% of electrical revolution

Table 3-2. Valve Part Number Specific Parameters (cont'd.)

Parameter Name	Description	Value/Units
SetPosZeroCutOffParams		
Mode	Turns on or off the zero cut off function	0 = Off 1 = On
LowLimit	Zero cut off will be turned on below this stroke	%
HighLimit	Zero cut off will be turned off above this limit	%
DelayTime	Delay time before zero cut off is turned on	ms
ModelPositionErrParams		
PosErrMotorAlarmTime	Motor resolver delay time before a position error is flagged as an alarm	sec
PosErrMotorAlarmLimit	Alarm limit for error allowed between the position demand and the motor resolver feedback	%
PosErrMotorShutdownTime	Motor resolver delay time before a position error creates a shutdown	sec
PosErrMotorShutdownLimit	Shutdown limit for error allowed between the position demand and the motor resolver feedback	%
PosErrShaftAlarmTime	Shaft resolver delay time before a position error is flagged as an alarm	sec
PosErrShaftAlarmLimit	Alarm limit for error allowed between the position demand and the shaft resolver feedback	%
PosErrShaftShutdownTime	Shaft resolver delay time before a position error creates a shutdown	sec
PosErrShaftShutdownLimit	Shutdown limit for error allowed between the position demand and the shaft resolver feedback	%
NoiseFilterParams		
NoiseFilterMode	Selects noise filter mode	
Bandwidth	Input noise filter bandwidth	Hz
Damping	Input noise filter damping	Typical 2nd order response is 1.0
Threshold	Below this threshold the gain setting will be used, above this threshold the gain setting will be set to 1.0	%
Gain	Input noise filter gain	

Table 3-2. Valve Part Number Specific Parameters (cont'd.)

Parameter Name	Description	Value/Units
PaceMakerParams		
Mode	Turns on or off the pace maker function	0 = Off 1 = On
DelayTime	Delay time between pace maker pulses	min
PositionStep	Position demand magnitude for the pace maker pulse	%
ImpulseHalfDuration	Time pulse remains high, also time pulse remains low	ms

Valve Serial Number Specific Parameters

Each valve, regardless of valve type or part number, will have a set of unique settings corresponding to the calibration process done on each unit at the factory. Refer to the table below for a definition of these settings. Please contact Woodward in the event these values need to be entered into the DVP.

Table 3-3. Valve Serial Number Specific Parameters

Parameter Name	Description	Value
ValveTypeId		
ValveSerialNum	Valve assembly serial number	Factory Calibrated
ResolverScalingParms		
Shaft1Resolver.LelaScaling.Length1	Secondary resolver calibration	Factory Calibrated
Shaft1Resolver.LelaScaling.Length2	Secondary resolver calibration	Factory Calibrated
Shaft1Resolver.LelaScaling.Xoffset	Secondary resolver calibration	Factory Calibrated
Shaft1Resolver.LelaScaling.YatZero	Secondary resolver calibration	Factory Calibrated
Shaft1Resolver.LelaScaling.YatMax	Secondary resolver calibration	Factory Calibrated
Shaft1Resolver.LelaScaling.ROffset	Secondary resolver calibration	Factory Calibrated
Shaft1Resolver.LelaScaling.RRollOver	Secondary resolver calibration	Factory Calibrated
BLDCPosStateParams		
MinCheckMotorResMin	Startup diagnostic limit	Factory Calibrated
MinCheckMotorResMax	Startup diagnostic limit	Factory Calibrated
MinCheckShaftResMin	Startup diagnostic limit	Factory Calibrated
MinCheckShaftResMax	Startup diagnostic limit	Factory Calibrated
MaxCheckMotorResMin	Startup diagnostic limit	Factory Calibrated
MaxCheckMotorResMax	Startup diagnostic limit	Factory Calibrated
MaxCheckShaftResMin	Startup diagnostic limit	Factory Calibrated
MaxCheckShaftResMax	Startup diagnostic limit	Factory Calibrated
MotorResolverOffset	Startup diagnostic limit	Factory Calibrated
SetPosOffsetParams.Offset	Calibration position offset	Factory Calibrated

Electrical Connections

WARNING

Due to the hazardous location listings associated with this product, proper wire type and wiring practices are critical to operation.

NOTICE

Do not connect any cable grounds to "instrument ground", "control ground", or any non-earth ground system. Make all required electrical connections based on the wiring diagrams (Figure 1-7).

⚠CAUTION

For best noise immunity, and to prevent damage to on-board actuator instruments, the motor power cables should be run in separate cable trays or conduits from the motor resolver cables and any other low-level signal cables.

This product is designed for use with three (or four with optional redundant motor resolver) dedicated cables that connect the Digital Valve Positioner to the LESV II assembly. These cables must be used for the system to meet all regulatory requirements for hazardous and ordinary locations, as well as EMC requirements. Please contact Woodward for the appropriate cable configuration.

Refer to the outline drawings (Figures 1-2 through 1-7) for location of grounding lug in order to properly earth ground the LESV II.

Figures 3-11, 3-12, 3-13, 3-14, and 3-15 show drawings of the five typical dedicated cables used to connect the LESV II valve to the DVP driver. The drawings in these figures include wiring diagrams and connector descriptions. Application specific requirements such as termination at the DVP, length and environmental conditions, key orientation, etc., may result in a custom implementation of these cables by the customer.

⚠WARNING

Electrical circular connectors must be properly seated and tightened to provide correct performance, to eliminate potential shock hazard, and to maintain the LESV II's IP rating.

Power Connector

The mating power cable connector shall be installed hand-tight followed by a final torque of 2.5 Nm (22 lb.-in) to meet the IP rating.

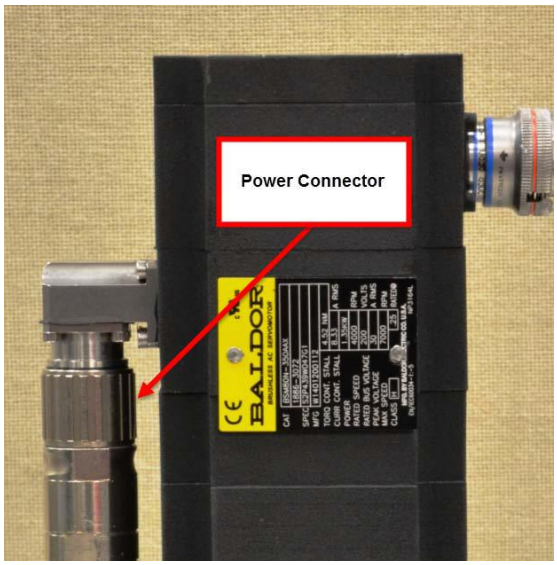

Figure 3-8. Power Connector

Note: Actual connector orientation on motor may appear different than that shown.

Motor Resolver Connectors (Two Resolvers)

Install these two mating cable connectors by hand, so that the red line is no longer visible, and the connector cannot be turned any further.

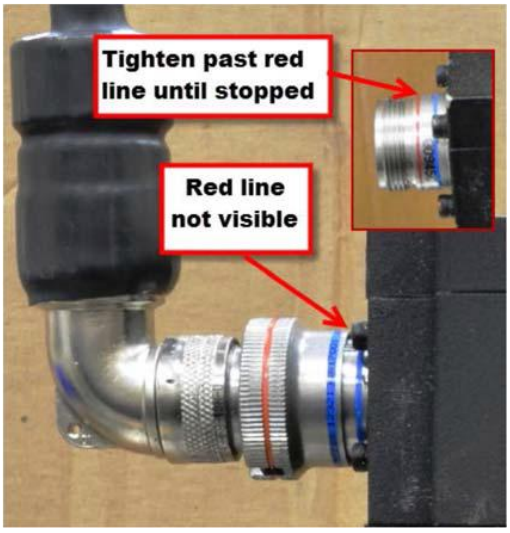

Figure 3-9. Motor Resolver Connectors

ID Module/Shaft Resolver Actuator Connector

Install the mating cable connector by hand, so that the red line is no longer visible, and the connector cannot be turned any further.

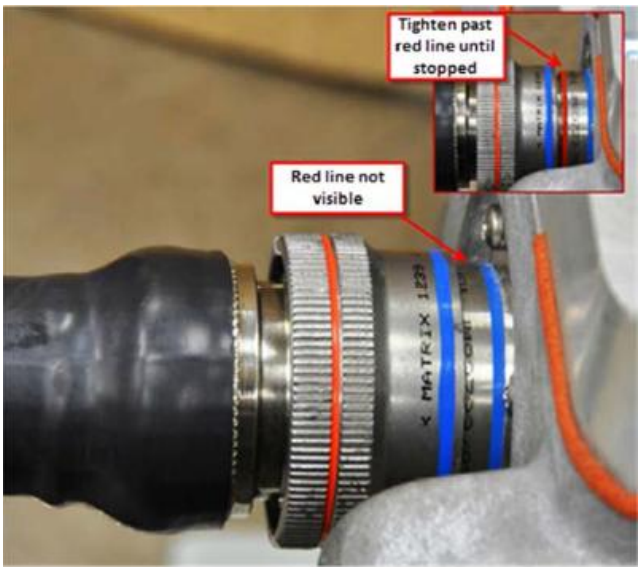

Figure 3-10. ID Module/Shaft Resolver Actuator Connector

Note: Actual connector location on actuator may appear different than that shown.

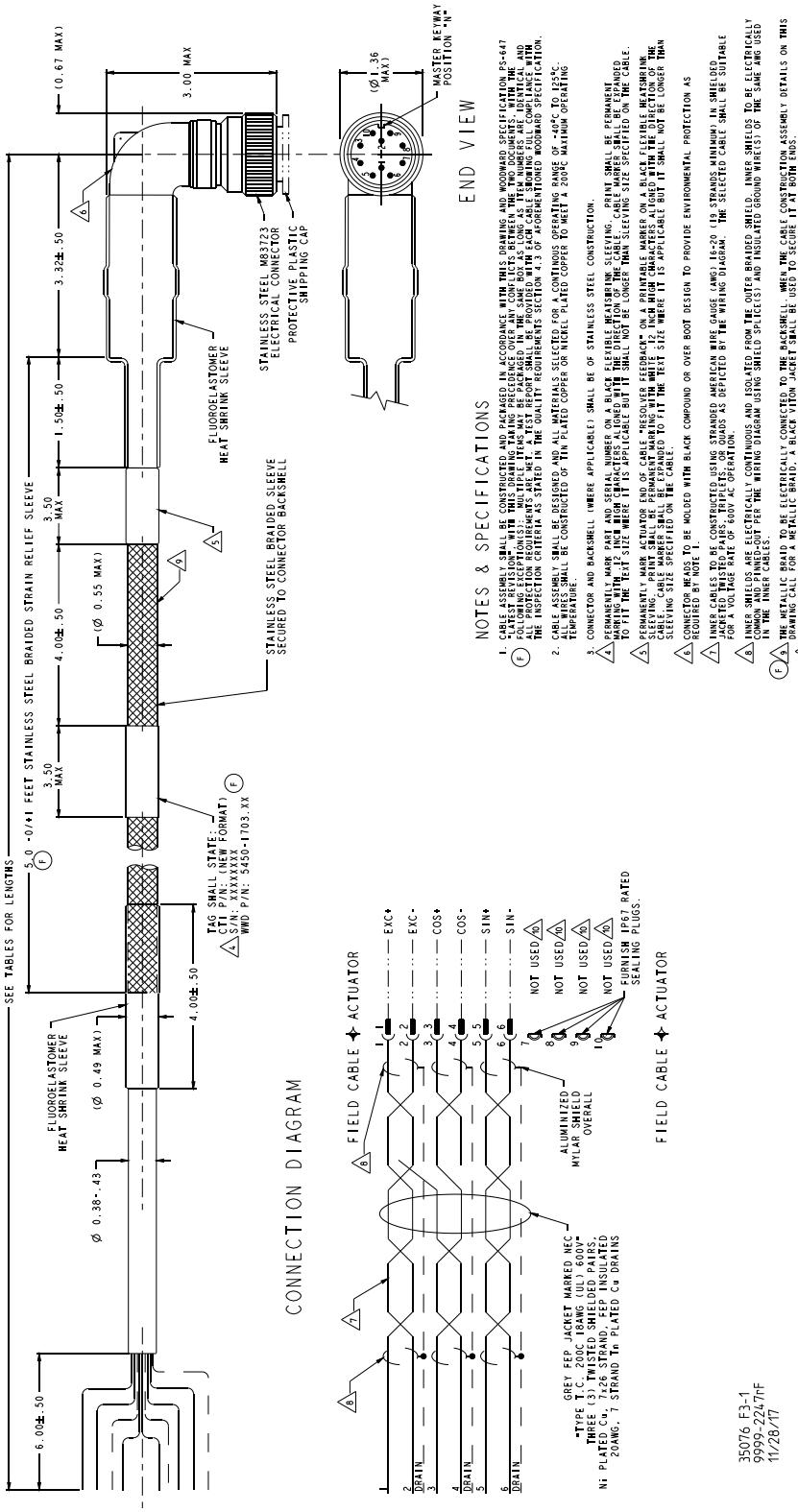

Figure 3-11. Cable, Motor Resolver 1, Feedback Signal

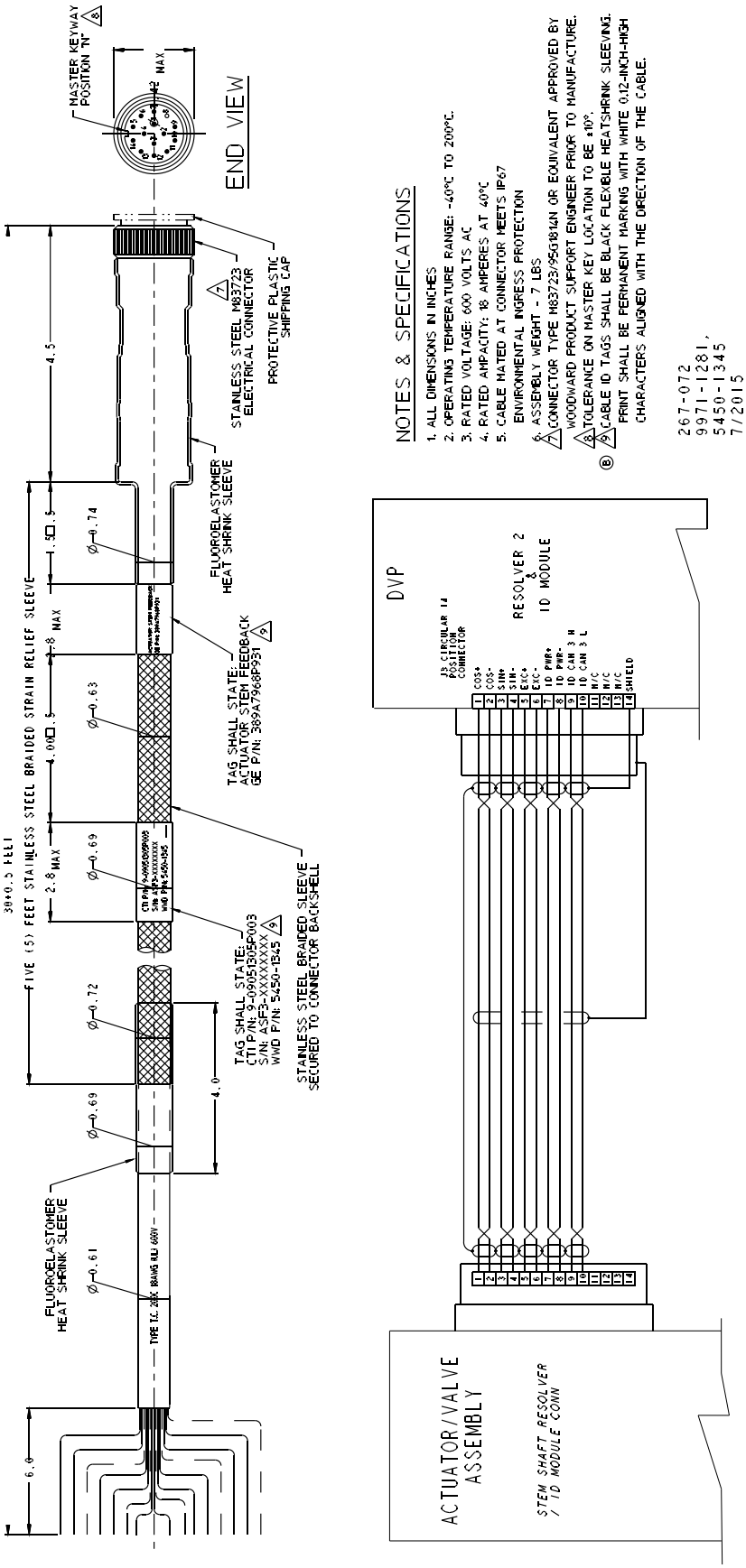

Figure 3-12. Cable, Stem Shaft Resolver/LVDT, Feedback Signal

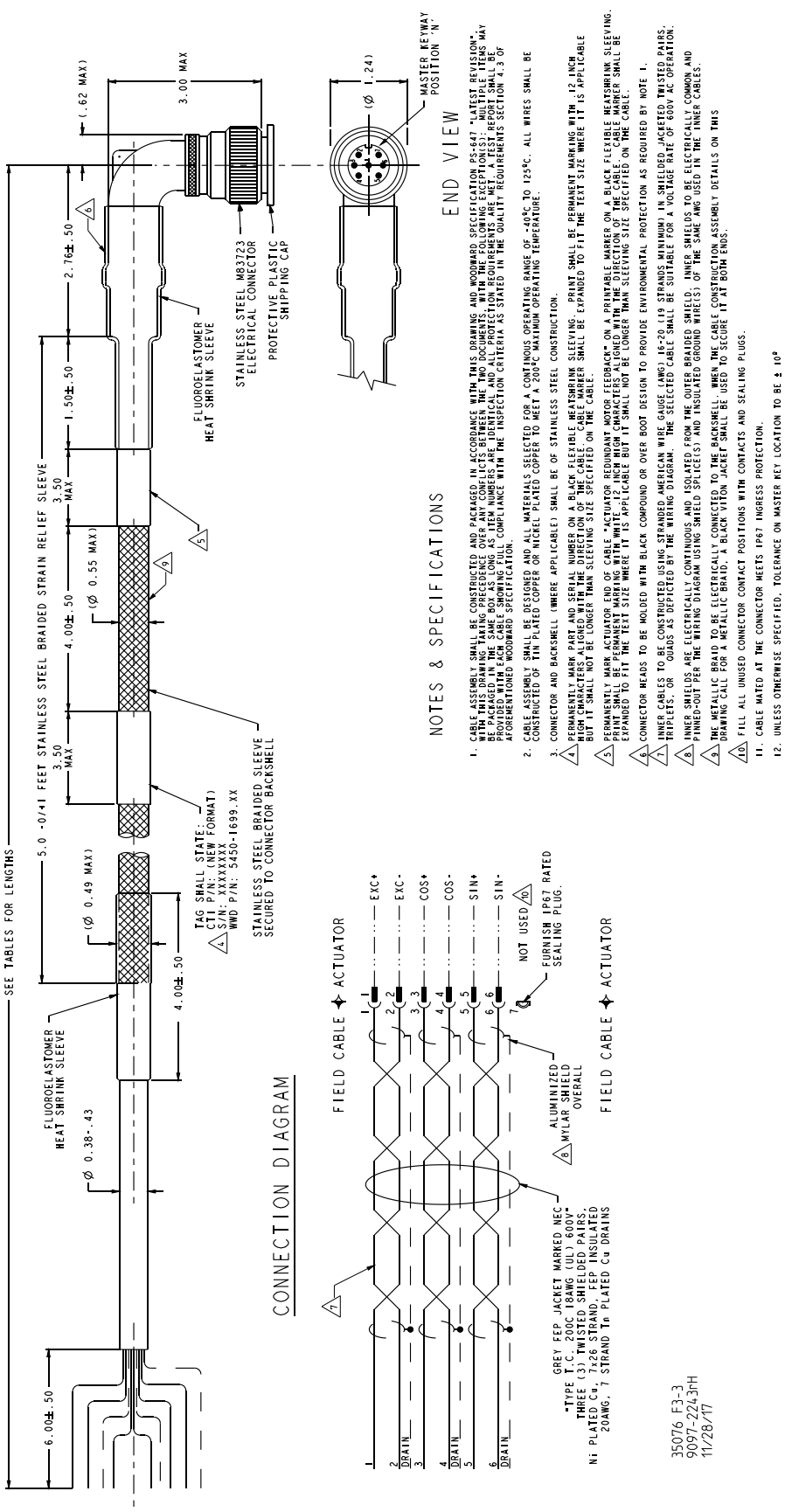

Figure 3-13. Cable, Motor Resolver 2, Feedback Signal

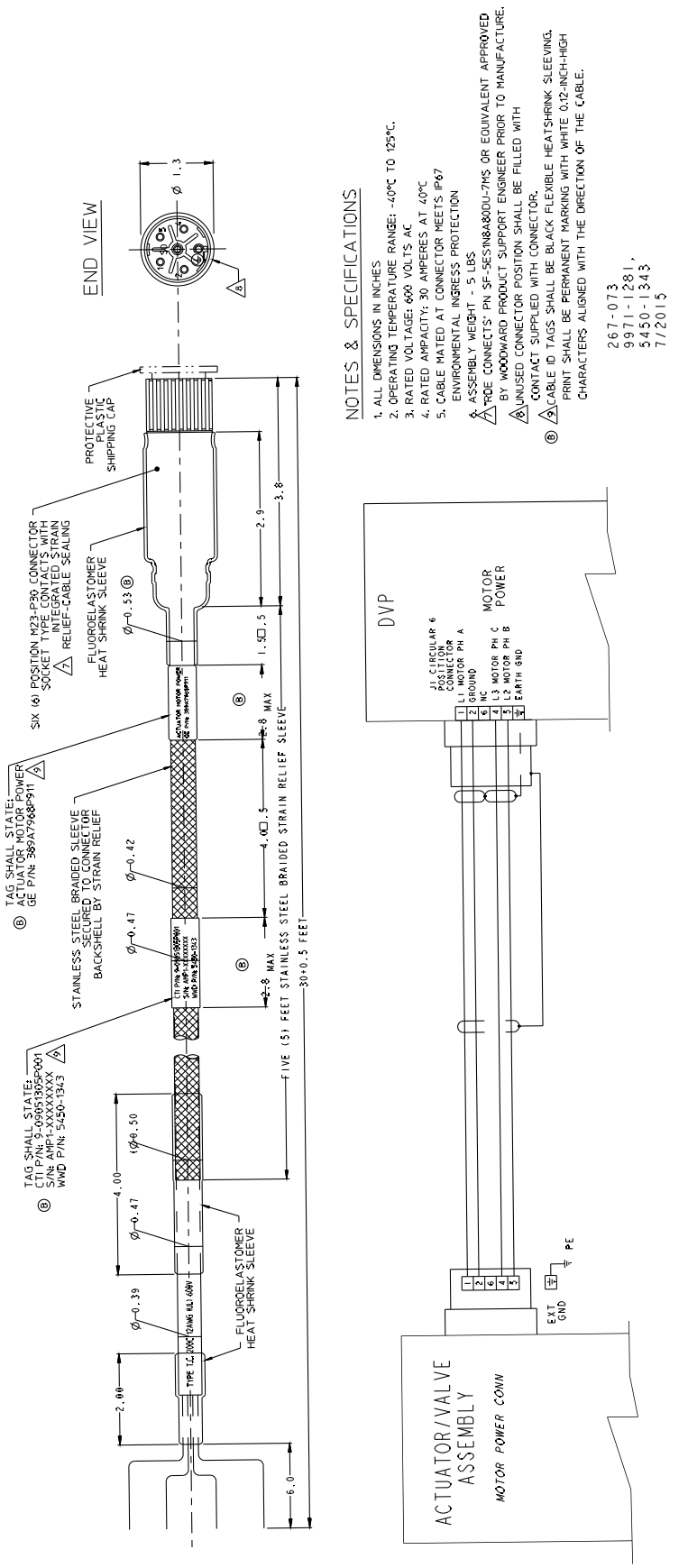

Figure 3-14. Cable, Motor Power– 2-Inch LESV II (LELA1 with DVP5k)

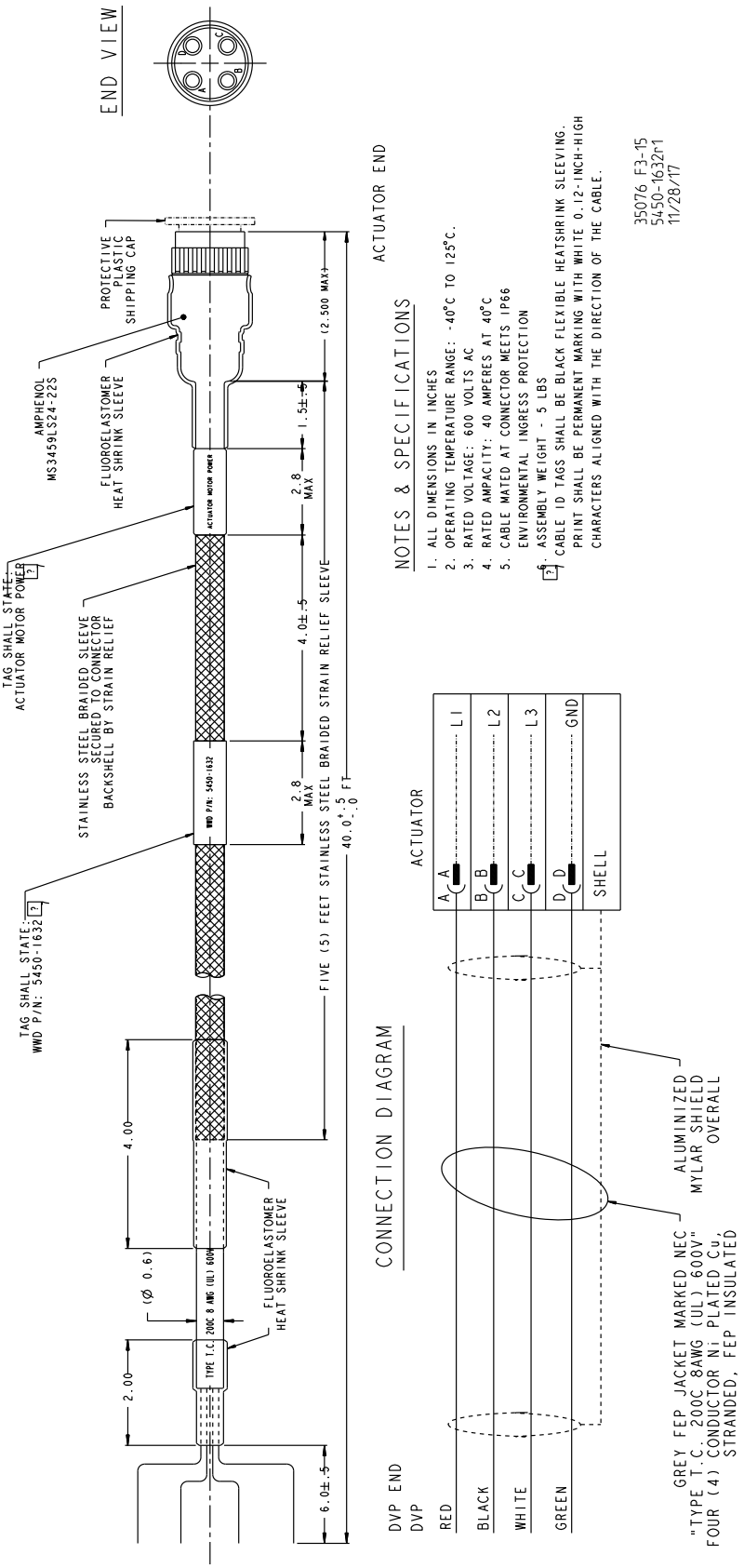

Figure 3-15. Cable, Motor Power– 3, 4, and 6-Inch LESV II (LELA2 with DVP12k)

SIL2 Flow Sensor - Electrical Wiring

The SIL2 sensor housing is manufactured with a 1/2” NPT electrical conduit connection. The SIL2 sensor is shipped with a cable gland fitting installed into this NPT connection for use in European applications; the cable gland fitting is designed for use with cable diameters of 10 mm to 14 mm. For North American applications, this cable gland fitting can be removed and discarded, and the customer conduit is installed directly into the NPT connection.

The SIL2 sensor electrical connection terminal block is located inside the sensor housing under the removable cover. To access the terminal block, remove the five hex-head cap screws that secure the cover to the housing using a 3 mm hex wrench. Refer to Figures A and B for the location of the cover screws and electrical terminal block. To access the terminal block more easily, as shown in Figures C and D, the sensor housing may be removed by removing the six mounting screws.

To connect customer wiring to the SIL2 sensor terminal block, insert a screwdriver into the terminal block to pry open the spring-loaded connectors as shown in Figure E, but use caution not to apply excessive force. Refer to Figure 1-6 for terminal definition.

Once the wiring connections are secured, re-install the sensor housing and sensor cover and torque each screw to 0.9 Nm / 8 lb.-in. Note that the conduit entry/cable gland fitting may be oriented in 60° increments from the as-shipped position.

Figure A

Figure B

Figure C

Figure D

Figure E

Installation and Application Pre-Start Checks

Every LESV II installation should include, as a minimum, the recommended checks outlined in table below.

WARNING

All prime mover OEM recommendations and all required plant safety checks must always be followed and supersede any recommended actions. It is the responsibility of the end user to ensure all procedures are carried out in a safe manner.

WARNING

Never put your hands into the valve housing. There are moving components with tight clearances, and large closing forces. Valve position should only be verified by using the visual position indicator on the side of the valve actuator.

Recommended Commissioning Procedures
Electrically Actuated Gas Control Valves

Table 3-4. Commissioning Procedure

Commissioning Phase: Installation (Before fuel or power are applied to system)	
Wiring	Connectors Shielding Point to point verification Wire rating / gage / type Wire routing / length Power source - voltage / current Power redundancy Hazardous Location compliance CAN termination applied correctly
Physical / Mechanical Installation	Flush system prior to installation of control valve Valve and DVP mounting - torque, vibration isolation Pipe sizes Pump flow rate / pressure OBVD vents connected properly Piping connections / loads Flange bolt torques and seals Verify product rating (Pressure, Environment, Listings No piping obstructions Fuel system flushing
Turbine Control Integration	Verify independent overspeed system
Commissioning Phase: Pre-operational Checks (Before applying fuel to system)	
Wiring	
Physical / Mechanical Installation	Verify fuel compatibility / quality
Turbine Control Integration	Configure DVP for control system Verify communications Verify fault and diagnostic behavior (trip setting) Demand and feedback loop check 0-100% Visual check of correct valve movement Verify internal shutdown operation and annunciation Verify independent shutdown function and annunciation Recommend demand is 0% at shutdown Verify low demand signal noise Verify voltage at DVP within limits during full valve step Verify shutdown from safety system including overspeed Document and archive DVP configuration settings
Commissioning Phase: Pre-start (before turbine lightoff)	
Wiring	
Physical / Mechanical Installation	Verify no leaks

Table 3-4. Commissioning Procedure (cont'd.)

Commissioning Phase: Pre-start (before turbine lightoff) (cont'd.)	
Turbine Control Integration	Wet motor test recommended Verify purge sequence operation Flow rate verification (manifold pressure) Verify internal shutdown operation and annunciation Verify independent shutdown function and annunciation Verify shutdown from safety system including overspeed
Commissioning Phase: Operational	
Wiring	
Physical / Mechanical Installation	Verify operating temperatures, Valve and DVP
Turbine Control Integration	Verify fuel flow stability (manifold pressure) Flow rate verification (manifold pressure and/or flow meter) Verify transient performance Verify low demand signal noise Verify fuel schedule and emissions compliance

Preservation and Storage

Woodward products are packaged and shipped to the most stringent industry standards for international shipments. In most cases, Woodward products are constructed with stainless steel and other corrosion resistance materials. Products not manufactured from these materials are provided with a corrosion inhibiting coating to best protect the item under normal conditions.

To maintain the Woodward warranty, items must be stored in a clean, dry environment free of ingress from any foreign debris (including animals, insects, and other organic materials). The preferred method of storage is to keep the product in the "as shipped" containers until the product is installed per the O&M manual. If this is not possible, each product is shipped with covers to prevent ingress of normal materials to the internals of the product. These shipping covers must not be removed until the product is installed per the O&M manual.

Products for the intended use of containing pressurized fluid of any kind will contain various styles of seals. After extended periods of storage (greater than 12 months), these seals can "take a set" and may allow leakage during the initial use of the product.

Prior to use, Woodward recommends that the product be pressurized and manually stroked over its full stroke for at least five minutes or 100 cycles, whichever occurs first. This cycling will enable the seals to regain their preferred shape and provide optimal sealing for the remainder of the product life.

Products that include electronic components (internal driver or other circuit boards) should be powered at least once every six months. This process will ensure the integrity of the electrical components for the remainder of the product life.

Following these general recommendations will allow Woodward products to be stored for long periods of time without degradation to the product performance. Please contact a Woodward representative for more detailed information or for questions based upon specific field conditions. When storing beyond three years it is recommended to return to the factory for recertification as seals can take a set.

Chapter 4.
Maintenance and Hardware Replacement

Maintenance

The only maintenance required for the Large Electric Sonic Valve is lubricating the ball screw and bearing and inspecting the fuel overboard vent port every 12 months. For 2” LESV II, refer to manual 35134. For the 3”, 4”, and 6” LESV II, refer to manual 35103.

Except for the SIL2 Flow Sensor, the LESV II is not designed with field-replaceable components. Contact the turbine manufacturer (primary contact) or Woodward (secondary contact) for assistance in the event there is a problem requiring service or replacement.

Hardware Replacement

⚠WARNING

EXPLOSION HAZARD—Substitution of components may impair suitability for Class I, Division 2, or Zone 2.

⚠WARNING

To prevent possible serious personal injury, or damage to equipment, be sure all electric power, hydraulic pressure, and gas pressure have been removed from the valve and actuator before beginning any maintenance or repairs.

⚠WARNING

Lift or handle the valve only by using the eyebolts (see Lifting Procedures in Chapter 3).

⚠WARNING

Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the Large Electric Sonic Valve. Noise levels of greater than 90 dB are possible.

⚠WARNING

The surface of this product can become hot enough or cold enough to be a hazard. Use protective gear for product handling in these circumstances. Temperature ratings are included in the specification section of this manual.

⚠WARNING

The LESV II contains a mechanical spring under load. Do not disassemble, as this spring can cause bodily harm.

SIL2 Flow Sensor Replacement

For SIL2 Flow Sensor Replacement for the 2”, 3”, 4”, and 6” LESV II, refer to CMM-03010.

Fuel Overboard Vent Port

There is a fuel overboard vent port that must be vented to a safe location. In normal operation, this vent should have very low leakage. However, if excessive leakage is detected from this vent port, contact a Woodward representative for assistance.

NOTICE

Never plug the fuel overboard vent port, which could cause the valve to malfunction or to operate improperly.

Fuel Overboard Vent Port Annual Inspections

Pressurize the valve section of the assembly to a pressure of 345 kPa (50 psig) and perform the following inspections:

- Inspect external sealing surfaces for leakage using leak detect fluid (no leakage is permitted). These locations include the inlet and discharge flange connections, as well as the pilot sleeve/valve body interface.

- Inspect for excessive overboard vent leakage (100 cm^3/min maximum / 6.1 in^3/min) from the Fuel Overboard Vent Port.

Chapter 5.
Troubleshooting

Faults in the fuel control or governing system are often associated with speed variations of the prime mover, but such speed variations do not always indicate fuel control or governing system faults. Therefore, when improper speed variations occur, check all components, including the engine or turbine, for proper operation. Refer to the applicable electronic control manuals for assistance in isolating the trouble. The following steps describe troubleshooting for the gas fuel control valve.

Disassembly of the Large Electric Sonic Valve in the field is not recommended due to the dangerous forces contained in the springs. Under unusual circumstances, where disassembly becomes necessary, all work and adjustments should be made by personnel thoroughly trained in the proper procedures. When inspecting the valve for suspected blockages remove the valve from the fuel system and only inspect with the unit powered off.

⚠WARNING

The LESV II contains a mechanical spring under load. Do not disassemble, as this spring can cause bodily harm.

⚠WARNING

When inspecting the valve internally through the flanges for potential blockages remove the valve from the fuel system and ensure that all power and electrical cables are disconnected. Never place hands inside the valve without ensuring that power is disconnected, and the position indicator shows the valve is at the closed position.

⚠WARNING

Do not operate the valve without proper support for the diverging sleeve. The diverging sleeve can only be properly supported by bolting and by properly torquing the outlet flange to either piping or an equivalent flange. Do not place hands inside the valve body during inspection, cleaning, or operation.

Note: When requesting information or service help from Woodward, it is important to include the part number and serial number of the valve assembly in your communication.

Table 5-1. Troubleshooting Guide

Symptom	Possible Causes	Remedies
Valve will not open because the DVP will not reset	Motor wires not properly connected between DVP and actuator.	Conduct continuity check.
	Resolver wires not properly connected between DVP and actuator.	Conduct continuity check.
DVP will reset but valve will not open	Resolver sine wires high and low are flipped.	Conduct continuity check.
	Resolver cosine wires high and low are flipped.	Conduct continuity check.
	Resolver sine and cosine wires are swapped.	Conduct continuity check.

Table 5-1. Troubleshooting Guide (cont'd.)

Symptom	Possible Causes	Remedies
Upon enabling, valve will open and then fail closed	Resolver sine and cosine wires are swapped, and sine wires high and low are flipped.	Conduct continuity check.
	Resolver sine and cosine wires are swapped, and cosine wires high and low are flipped.	Conduct continuity check.
Poor flow accuracy	Characterization data in engine control does not match the valve.	Verify characterization data matches the valve serial number.
	Build-up of contamination on the seat.	Remove valve and inspect flow elements.
Poor position stability	One motor wire disconnected.	Conduct continuity check.
Valve stem resolver indicates position error	Incorrect parameter file loaded.	Verify the parameter file matches the valve serial number.
	Valve stem resolver wires not properly connected between DVP and actuator.	Contact manufacture for instructions or return to manufacturer for repair.
	Faulty resolver.	Return to manufacturer for repair.
	Drive train failure.	Return to manufacturer for repair.
High overboard vent leakage	Internal seals damaged.	Return to manufacturer for repair.
High seat leakage	Damage to valve seat or plug.	Remove valve and inspect flow elements. Return to manufacturer for repair.
	Contamination buildup in seat or plug.	Remove valve and inspect flow elements. Return to manufacturer for repair.
	Valve not fully closed.	Remove valve and verify plug is not properly seated. Return to manufacturer for repair.
External gas fuel leakage	Piping flange gaskets missing or deteriorated.	Replace gaskets.
	Piping flanges improperly aligned.	Rework piping as needed to achieve alignment requirements detailed in Chapter 3.
	Piping flange bolts improperly torqued.	Rework bolts as needed to achieve torque requirements detailed in Chapter 3.
	Packing missing or deteriorated.	Return actuator to Woodward for service.
SIL2 sensor output out of range at 0 % or 100 % travel (see specifications)	Piping flange gaskets missing or deteriorated.	Replace gaskets.
	Incorrect sensor wiring.	Verify supply voltage and sensor output connections are correct.
	Incorrect supply voltage.	Verify sensor supply voltage is within specifications.
	Faulty sensor.	Install replacement sensor.

Chapter 6.
Safety Management – Safe Position Fuel Shutoff Function

Product Variations Certified

The SIL rated LESV for fuel shutoff is designed and certified to the functional safety standards according to IEC61508, Parts 1 through 7. Reference the product FMEDA: WOO 17/07-039 R001, and Certification: WOO 1707039 C001.

The functional safety requirement in this chapter applies to all LESVs. The SIL rated LESVs will have a DU FIT of less than 826 FITS for Close to Trip Full Stroke.

According to IEC61508, the LESV is certified for use in applications up to SIL 3.

The LESV is designed and verified to withstand the worst-case (or greater) expected environmental conditions as listed in other sections of this manual.

Covered LESV Versions

All LESVs are SIL certified for the shutoff function.

SFF for the LESV – Over Speed SIF (Safety Instrumented Function)

The LESV is only one part of a shutoff system that supports an over-speed shutdown SIF. This system consists of a speed sensor, a processing unit, and a fuel shutoff actuation sub-system of which the LESV is a component.

The SFF for each subsystem should be calculated. The SFF summarizes the fraction of failures, which lead to a safe state, plus the fraction of failures which will be detected by diagnostic measures and lead to a defined safety action. This is reflected in the following formulas for SFF:

$$SFF = \lambda_{SD} + \lambda_{SU} + \lambda_{DD} / \lambda_{TOTAL}$$

Where $\lambda_{TOTAL} = \lambda_{SD} + \lambda_{SU} + \lambda_{DD} + \lambda_{DU}$

The failure rates listed below, for only the LESV, do not include failures due to wear-out of any components. They reflect random failures and include failures due to external events such as unexpected use. Reference the FMEDA: WOO 17/07-039 R001for detailed information concerning the SFF and PDF.

Table 6-1. Failure Rates According to IEC61508 in FIT

Device	λ_{SD}	λ_{SU}	λ_{DD}	λ_{DU}
Full Stroke	0	109	0	826
Full Stroke with PVST	108	1	370	456

According to IEC 61508-2, the architectural constraints of an element must be determined. This can be done by following the 1H approach according to 7.4.4.2 of IEC 61508-2 or the 2H approach according to 7.4.4.3 of IEC 61508-2. The 1H approach should be used for the LESV.

Response Time Data

Under normal operating conditions with maximum gas pressure applied to the LESV II, the full stroke response time is 1-second maximum from 100% position to fully closed. When the LESV II is offline with no gas pressure, the full stroke response time is 750 milliseconds maximum from 100% position to fully closed.

Limitations

When proper installation, maintenance, proof testing, and environmental limitations are observed, the useful life of the LESV II is 48,000 hours of operation. The LESV II can be refurbished, and a product life of 20 years can be achieved.

Management of Functional Safety

The LESV is intended for use according to the requirements of a safety lifecycle management process such as IEC61508 or IEC61511. The safety performance numbers in this chapter can be used for the evaluation of the overall safety lifecycle.

Restrictions

The user must complete a full functional check of the LESV after initial installation, and after any modification of the overall safety system. No modification shall be made to the LESV unless directed by Woodward. This functional check should include as much of the safety system as possible, such as sensors, transmitters, actuators, and trip blocks. The results of any functional check shall be recorded for future review.

The LESV must be used within the published specification in this manual.

Competence of Personnel

All personnel involved in the installation and maintenance of the LESV must have appropriate training. Training and guidance materials are included in this manual.

These personnel shall report to Woodward any failures detected during operation that may impact functional safety.

Operation and Maintenance Practice

A periodic proof (functional) test of the LESV is required to verify that any dangerous faults not detected by safety controller internal run-time diagnostics are detected. More information is in the “Proof Test” section below. The frequency of the proof test is determined by the overall safety system design, of which the LESV is part of the safety system. The safety numbers are given in the following sections to help the system integrator determine the appropriate test interval.

The LESV requires no special tools for operation or maintenance of the LESV.

Installation and Site Acceptance Testing

Installation and use of the LESV must conform to the guidelines and restrictions included in this manual. No other information is needed for installation, programming, and maintenance.

Functional Testing after Initial Installation

A functional test of the LESV is required prior to use in a safety system. This should be done as part of the overall safety system installation check and should include all I/O interfaces to and from the LESV. For guidance on the functional test, see the Proof Test procedure below.

Functional Testing after Changes

A functional test of the LESV is required after making any changes that affect the safety system. Although there are functions in the LESV that are not directly safety related, it is recommended that a functional test be performed after any change.

Proof Test (Functional Test)

The LESV must be periodically proof tested to ensure there are no dangerous faults present that are not detected by on-line diagnostics. This proof test should be performed at least once per year.

Suggested Proof Test

The suggested proof test consists of a full stroke of the valve, shown in the table below.

Table 6-2. Suggested Proof Test

Step	Action
1	Bypass the safety function and take appropriate action to avoid a false trip.
2	Interrupt or change the signal/supply to the actuator to force the actuator and valve to the Fail-Safe state and confirm that the Safe State was achieved and within the correct time.
3	Re-store the supply/signal to the actuator and inspect for any visible damage or contamination and confirm that the normal operating state was achieved.
4	Inspect the valve for any leaks, visible damage, or contamination.
5	Remove the bypass and otherwise restore normal operation.

For the test to be effective, the movement of the valve must be confirmed. To confirm the effectiveness of the test both the travel of the valve and slew rate must be monitored and compared to expected results to validate the testing.

Proof Test Coverage

The Proof Test Coverage for the LESV is given in the table below.

Table 6-3. Proof Test Coverage

Application	Safety Function	$\lambda_{DU}PT^{6}$	Proof Test Coverage	
			No PVST	with PVST
Clean Service	Close on Trip – Full Stroke	**272**	**67%**	**40%**

The suggested proof test and proof test coverage is referenced in the product FMEDA; WOO 17/07-039 R001.

Chapter 7.
Safety Management – Position Feedback
Lightoff Function Flow Sensor

Product Variations Certified

The SIL rated LESV (also known as LESV–Flow Sensor) is designed and certified to the functional safety standards according to IEC61508, Parts 1 through 7. Reference the product FMEDA: WOO 17/07-039 R002 and Certificate: WOO 1707039 C002.

The functional safety requirements in this chapter apply to all LESVs that have a SIL-rated position sensor installed (see table below). The SIL-rated position sensor option was discontinued in May 2023 and is no longer available on new production units.

The LESV II – Flow Sensor is intended for use in applications at a SIL2 system level according to IEC61508 and is capable of SIL3 when implemented with appropriate system redundancies.

The LESV–Flow Sensor is designed and verified to withstand the worst-case (or greater) expected environmental conditions as listed in other sections of this manual.

Covered LESV Versions

The table below identifies the LESVs that are SIL certified for the lightoff function.

Table 7-1. SIL Certified LESVs

Valve Part Number	Flow Function SIL Level	Valve Shut-off Function SIL Level*	Valve Cg	Flange Rating (pounds)	Valve Size (inches)
9904-3440	Yes	Yes	2500	600	3
9904-3441	Yes	Yes	3655	600	4
9904-3442	Yes	Yes	6600	600	6
9904-3463	Yes	Yes	2500	600	3
9904-3464	Yes	Yes	3655	600	4
9904-3465	Yes	Yes	6600	600	6
9904-3777	Yes	Yes	2500	600	3
9904-3778	Yes	Yes	3655	600	4
9904-3779	Yes	Yes	6600	600	6

***Note:** For more detail in the shutoff SIF, see Chapter 6

The LESV II – Flow Sensor is only one part of a sensor subsystem that supports the entire lightoff SIF. The LESV II – Flow Sensor provides mechanical position feedback of the valve plug position. An accurate feedback device such as the MTS Temposonics position sensor must be used in order to produce the position signal. Accurate valve position feedback can be used as one of the inputs to calculate the flow through the LESV II.

$$SFF = \lambda_{DU} / \lambda_{TOTAL}$$

Where $\lambda_{TOTAL} = \lambda_{SD} + \lambda_{SU} + \lambda_{DD} + \lambda_{DU}$

The failure rates listed below, for only the LESV–Flow Sensor, do not include failures due to wear-out of any components. They reflect random failures and include failures due to external events such as unexpected use. Reference the FMEDA: WOO 17/07-039 R002 for detailed information concerning the SFF and PDF.

The failure rates listed below apply to the LESV II – Flow Sensor mechanical positioning aspect of the system, and do not include the failure rates of the MTS Temposonics position sensor. Refer to MTS safety manual 551504 for failure rates of the position sensor.

Table 7-2. Failure Rates According to IEC61508 in FIT

Device	λ_{SD}	λ_{SU}[2]	λ_{DD}	λ_{DU}
LESV–Flow Sensor	0	294	0	306

The SFF for the LESV–Flow Sensor supports architectural constraints up through a SIL 2 through the 2_H Route. The complete sensor subsystem, of which the LESV–Flow Sensor is a part, will need to be evaluated to determine the SFF for the subsystem.

When evaluating the sensor subsystem SFF, it should be noted that high temperature fuel flow through the LESV II may elevate the temperature of the position sensor mounting interface as much as 5°C higher than the ambient environment of the LESV II. This increase in the position sensor temperature environment should be considered in the evaluation of the subsystem.

Response Time Data

The LESV, through the SIL rated Position Sensor, provides position information to the safety controller. There is not a definable, detectable response time for the actuator.

Limitations

When proper installation, maintenance, proof testing, and environmental limitations are observed, the useful life of the LESV II – Flow Sensor is 48,000 hours of operation. The LESV II can be refurbished, and a product life of 20 years can be achieved.

Management of Functional Safety

The LESV–Flow Sensor is intended for use according to the requirements of a safety lifecycle management process such as IEC61508 or IEC61511. The safety performance numbers in this chapter can be used for the evaluation of the overall safety lifecycle.

Restrictions

The user must complete a full functional check of the LESV–Flow Sensor after initial installation, and after any modification of the overall safety system. No modification shall be made to the LESV–Flow Sensor unless directed by Woodward. This functional check should include as much of the safety system as possible, such as sensors, transmitters, actuators, and trip blocks. The results of any functional check shall be recorded for future review.

The LESV–Flow Sensor must be used within the published specification in this manual.

Competence of Personnel

All personnel involved in the installation and maintenance of the LESV–Flow Sensor must have appropriate training. Training and guidance materials are included in this manual.

These personnel shall report back to Woodward any failures detected during operation that may impact functional safety.

Operation and Maintenance Practice

A periodic proof (functional) test of the LESV–Flow Sensor is required to verify that any dangerous faults not detected by safety controller internal run-time diagnostics are detected. More information is in the “Proof Test” section below. The frequency of the proof test is determined by the overall safety system design, of which the LESV–Flow Sensor is part of the safety system. The safety numbers are given in the following sections to help the system integrator determine the appropriate test interval. The LESV–Flow Sensor requires no special tools for operation or maintenance of the LESV–Flow Sensor.

Installation and Site Acceptance Testing

Installation and use of the LESV–Flow Sensor must conform to the guidelines and restrictions included in this manual. No other information is needed for installation, programming, and maintenance.

Functional Testing After Initial Installation

A functional test of the LESV–Flow Sensor is required prior to use in a safety system. This should be done as part of the overall safety system installation check and should include all I/O interfaces to and from the LESV–Flow Sensor position sensor element. For guidance on the functional test, see the Proof Test procedure below.

Functional Testing After Changes

A functional test of the LESV–Flow Sensor is required after making any changes that affect the safety system. Although there are functions in the LESV–Flow Sensor that are not directly safety related, it is recommended that a functional test be performed after any change.

Proof Test (Functional Test)

The LESV–Flow Sensor must be periodically proof tested to ensure there are no dangerous faults present that are not detected by on-line diagnostics. This proof test should be performed at least once per year.

Functional Verification (Proof) Test Procedure (Module Level)

The suggested transmitter proof test consists of a three-point calibration check (see table below). The suggested proof test will detect 90% of possible DU failures in the LESV–Flow Sensor. This proof test detects failure of the LESV–Flow Sensor as well as the transmitter.

Table 7-3. Suggested Proof Test

Step	Action
1	Bypass the safety function and take appropriate action to avoid a false trip.
2	Set the valve to its Zero position.
3	Stroke the valve through its full range of motion to its Full-scale position to confirm full range of motion.
4	Return the valve to its Zero position.
5	Perform a three-point calibration of the transmitter over the full intended working range.
6	Remove the bypass and otherwise restore normal operation.

This is referenced in the product FMEDA: WOO 17/07-039 R002.

Chapter 8.
Product Support and Service Options

Product Support Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM or Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.

A current list of Woodward Business Partners is available at:
https://www.woodward.com/en/support/industrial/service-and-spare-parts/find-a-local-partner

Product Service Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (Woodward North American Terms and Conditions of Sale 5-09-0690) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward North American Terms and Conditions of Sale 5-09-0690).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward North American Terms and Conditions of Sale 5-09-0690) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward North American Terms and Conditions of Sale 5-09-0690). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:

- Return authorization number
- Name and location where the control is installed
- Name and phone number of contact person
- Complete Woodward part number(s) and serial number(s)
- Description of the problem
- Instructions describing the desired type of repair

Packing a Control

Use the following materials when returning a complete control:

- Protective caps on any connectors
- Antistatic protective bags on all electronic modules
- Packing materials that will not damage the surface of the unit
- At least 100 mm (4 inches) of tightly packed, industry-approved packing material
- A packing carton with double walls
- A strong tape around the outside of the carton for increased strength

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- The part number(s) (XXXX-XXXX) that is on the enclosure nameplate
- The unit serial number, which is also on the nameplate

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact one of the Full-Service Distributors listed at **https://www.woodward.com/en/support/industrial/service-and-spare-parts/find-a-local-partner**

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at **https://www.woodward.com/support**, which also contains the most current product support and contact information.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used in Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 (12) 295 13 00
United States	+1 (970) 482-5811

Products Used in Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used in Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+ 82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 (12) 295 13 00
United States	+1 (970) 482-5811

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number

Prime Mover Information

Manufacturer _____

Turbine Model Number _____

Type of Fuel (gas, steam, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.) _____

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Symptoms

Description _____

_____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Revision History

Revision U—
- Replaced both EU DoCs

Revision T—
- Added recommendations on corrosive fuels in Chapter 1

Revision R—
- Added Caution statement regarding cable separation under Electrical Connections in Chapter 3

Revision P—
- Removed CE line from Pressure Equipment Directive (Valve)
- Updated EU DoC 00371-04-EU-02-03
- Updated EU DoC 00371-04-EU-02-02

Revision N—
- Corrected NACE reference in introduction
- Stated SIL2 flow-sensor obsolescence

Revision M—
- New content added to the Introduction section.
- Revised Table 1-1

Revision L—
- Added additional valve part numbers to Table 7-1
- Updated Regulatory Compliance section

Revision K—
- Updated Korean Certification (KC Mark) in Regulatory Compliance section
- Replaced all Declarations

Revision J —
- Added Korean Certification to Regulatory Compliance section
- Added a Preservation and Storage section to Chapter 3

Revision H —
- Replaced Figures 1-2a through 1-5b with current drawings
- Replaced Declarations

Revision G —
- Revised PED (Valve) Directive in Regulatory Compliance section

Revision F —
- Revised PED (Valve) Directive in Regulatory Compliance section
- Replaced both DoCs.

Revision E —
- Edited ATEX Directive in Regulatory Compliance section
- Edited Pressure Equipment Directive in Regulatory Compliance section
- Added RoHS Directive in Regulatory Compliance section
- Replaced two Declarations.

Revision D —

- Updated PED BVUK certificate number in Regulatory Compliance section
- Changed clearance value for grease port E in Chapter 3
- Added Warning Box under Table 3-1 in Chapter 3
- Updated two Declarations.

Revision C —

- Updated IECEx (LELA) Certification in Regulatory Compliance section
- Multiple additions and edit to Table 1-1
- New Note 1 in Table 1-1
- Added Figures 1-2a, 1-2b (2” LESV II)
- Added Required Clearance for Lubrication Kit Syringes and Gun/Needle section including Figures 3-1 and 3-2 to Chapter 3
- Multiple edits and content changes to paragraph immediately below Figure 3-5
- Added Figure 3-6
- Added Power, Motor Resolver, and ID Module/Shaft Resolver Actuator Connector sections including Figures 3-8, 3-9, and 3-10 to Chapter 3
- Inserted Installation and Application Pre-Start Checks section in Chapter 3
- New reference to Lubrication Manual in Maintenance section of Chapter 4
- Added clarification to third Warning box under Hardware Replacement in Chapter 4
- Added 2” to the references in the SIL2 Flow Sensor Replacement in Chapter 4
- Added DOC for LESVII with LELAI

Revision B —

- Removed “Standards” reference from IECEx (LELA2) listing in Compliance section
- Added North American Compliance section including CSA and ETL references to Compliance section
- Added sentence referring to LELA valve-actuator interface temperature to Special Conditions for Safe Use in Compliance section

Revision A —

- Added new paragraph in the General section of Chapter 3
- Added Lifting Procedures section including Notice and Warning, boxes, text, and figures to Chapter 3
- Modified the paragraph immediately below Table 3-1
- Renumbered Figures in Chapter 3 to account for adding new Figures 3-1 and 3-2
- Added Notice box below Figure 3-5
- Added part numbers 9904-3463, 9904-3464, and 9904-3465 to Table 7-1

Declarations

EU DECLARATION OF CONFORMITY

EU DoC No.:	00371-04-EU-02-03
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Contact Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Name(s)/Number(s):	Large Electric Sonic Valve - LESV II - with LELA 2 Actuator Sizes 3", 4", and 6" with ASME B16.34 Class 600 flanges With or without external position sensor
The object of the declaration described above is in conformity with the following relevant Union harmonization legislation:	**LELA 2 Actuator portion of LESV II:** Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC) **Valve portion of LESV II:** Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the harmonization of the laws of the Member States relating to the making available on the market of pressure equipment 3", 4": PED Category II 6": PED Category III
Markings in addition to CE marking:	**With external position sensor:** Ⓔx II 3 G, Ex db ec IIC T3 Gc **Without external position sensor:** Ⓔx II 3 G, Ex ec IIC T3 Gc
Applicable Standards:	ASME BPVC, VIII-2 (2015) – Rules for Construction of Pressure Vessels Division 2 – Alternative Rules EN IEC 60079-0: 2018 Explosive Atmospheres - Part 0: Equipment – General Requirements EN 60079-7:2015/A1: 2018 - Explosive Atmospheres – Part 7: Equipment protection by increased safety "e" EN 61000-6-4:2007/A1:2011 - Electromagnetic compatibility (EMC) - Part 6-4: Generic Standards – Emissions for Industrial Environments EN 61000-6-2:2005 - Electromagnetic compatibility (EMC) - Part 6-2: Generic Standards – Immunity for Industrial Environments
Conformity Assessment:	PED Module H – Full Quality Assurance CE-0062-PED-H-WDI 001-25-USA-rev-A Bureau Veritas SAS (0062) 4 Place des Saisons, 92400 COURBEVOIE, FRANCE

This declaration of conformity is issued under the sole responsibility of the manufacturer
We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Signature	Annette Lynch
Full Name	Engineering Manager
Position	Woodward, Fort Collins, CO, USA
Place	14 April 2025
Date	

5-09-1183 Rev 43

DECLARATION OF INCORPORATION
Of Partly Completed Machinery
2006/42/EC

File name:	00371-04-EU-02-01
Manufacturer's Name:	WOODWARD INC.
Contact Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Names:	Large Electric Sonic Valve (LESV, LESV II) Sizes 2", 3", 4", and 6", Class 300 and 600
This product complies, where applicable, with the following Essential Requirements of Annex I:	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7

The relevant technical documentation is compiled in accordance with part B of Annex VII. Woodward shall transmit relevant information if required by a reasoned request by the national authorities. The method of transmittal shall be agreed upon by the applicable parties.

The person authorized to compile the technical documentation:

Name: Dominik Kania, Managing Director
Address: Woodward Poland Sp. z o.o., ul. Skarbowa 32, 32-005 Niepolomice, Poland

This product must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of this Directive, where appropriate.

The undersigned hereby declares, on behalf of Woodward Inc. of Loveland and Fort Collins, Colorado that the above referenced product is in conformity with Directive 2006/42/EC as partly completed machinery:

MANUFACTURER

Signature

Annette Lynch

Full Name

Engineering Manager

Position

Woodward Inc., Fort Collins, CO, USA

Place

August 20, 2021

Date

Document: 5-09-1182 (rev. 18)

EU DECLARATION OF CONFORMITY

EU DoC No.:	00371-04-EU-02-02
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Contact Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Name(s)/Number(s):	Large Electric Sonic Valve with LELA Actuator ASME B16.34 Class 300 and 600 flanges LESV: 2, 3, 4 and 6 inch diameters LESV II: 2 inch diameter
The object of the declaration described above is in conformity with the following relevant Union harmonization legislation:	**LELA Actuator portion of LESV:** Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres **Valve portion of LESV:** Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the harmonization of the laws of the Member States relating to the making available on the market of pressure equipment 2", 3", 4": PED Category II 6": PED Category III **For models with ID Module or Position Sensor:** Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC)
Markings in addition to CE marking:	Ⓔx II 3 G, Ex nA IIC T3 Gc
Applicable Standards:	
PED:	ASME Boiler and Pressure Vessel Code VIII, Div. 2, 2010
ATEX:	EN IEC 60079-0, 2018: Electrical apparatus for explosive gas atmospheres – Part 0: General Requirements EN 60079-15, 2010: Electrical apparatus for explosive gas atmospheres – Part 15: Type of protection 'n'
EMC:	EN 61000-6-4, 2007/A1:2011: EMC Part 6-4: Generic Standards - Emissions for Industrial Environments EN 61000-6-2, 2005: EMC Part 6-2: Generic Standards - Immunity for Industrial Environments
Conformity Assessment:	PED Module H – Full Quality Assurance CE-0062-PED-H-WDI 001-25-USA-rev-A Bureau Veritas SAS (0062) 4 Place des Saisons, 92400 COURBEVOIE, FRANCE

This declaration of conformity is issued under the sole responsibility of the manufacturer
We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Signature	Annette Lynch
Full Name	Engineering Manager
Position	Woodward, Fort Collins, CO, USA
Place	14 April 2025
Date	

5-09-1183 Rev 43

Released

We appreciate your comments about the content of our publications.

Send comments to: industrial.support@woodward.com

Please reference publication 35076.

B 3 5 0 7 6 : U

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Woodward has company-owned plants, subsidiaries, and branches, as well as authorized distributors and other authorized service and sales facilities throughout the world.

Complete address / phone / fax / email information for all locations is available on our website.